THE CHEMICAL WATER QUALITY OF LAKE NIPISSING 1988-1990

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THE CHEMICAL WATER QUALITY

OF LAKE NIPISSING

1988-1990

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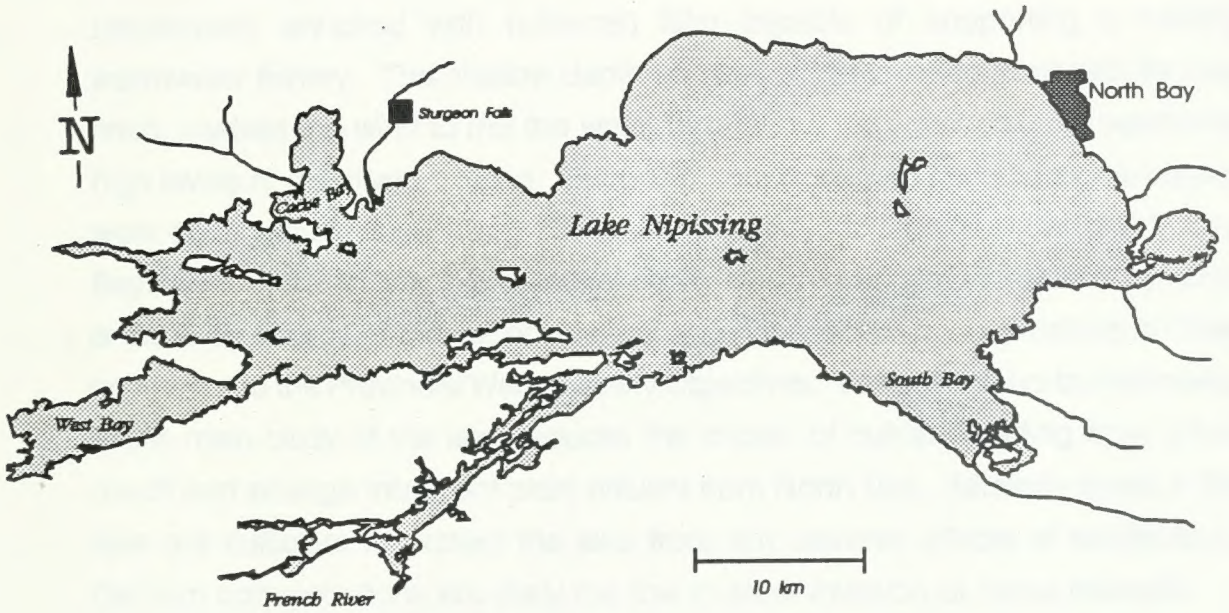
The Chemical Water Quality of Lake Nipissing 1988-1990



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Summary

The chemical water quality of Lake Nipissing was assessed between 1988 and 1990. Surveys were conducted monthly during the open water season at 26 stations throughout the lake. Results show that Lake Nipissing is a mesotrophic (moderately enriched with nutrients) lake capable of supporting a healthy warmwater fishery. The shallow depth of most of the lake, coupled with its long fetch, enables the wind to mix the water throughout the water column, sustaining high levels of dissolved oxygen. Eutrophic conditions and periodic algae blooms were observed in two relatively sheltered embayments: Callander Bay and Cache Bay. Agricultural activity in the watersheds of rivers flowing into these embayments is the likely source of the eutrophication, and phosphorus concentrations in these bays exceed the Provincial Water Quality Objectives. Vertical and horizontal mixing in the main body of the lake reduces the impact of nutrient loading from urban runoff and sewage treatment plant effluent from North Bay. Alkalinity levels in the lake are sufficient to protect the lake from any adverse effects of acidification. Calcium concentrations are likely too low to allow invasion of zebra mussels.

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1. Introduction

Ontario has a great wealth of lakes. Of the inland lakes, Lake Nipissing is the fourth largest, covering approximately 87,400 hectares or about 215,000 acres. Its watershed covers 13,100 km^2 and is made up of drainage from 12 major rivers. The lake is an important recreational resource in north central Ontario, serving thousands of cottagers and providing the revenue base for many commercial establishments. These are located primarily on the eastern end of the lake, where the City of North Bay is situated, and where access from primary highways is good.

Previous intensive chemical sampling of Lake Nipissing was conducted by the Ministry of the Environment in 1975, with earlier sampling efforts in 1971 and 1974. As part of the Inland Lakes Program, Lake Nipissing was sampled monthly during the ice-free season from 1988 to 1990. The program is designed to update the status of major inland lakes, and to use this information to amend a database of water chemistry on inland lakes in Ontario. This report summarizes the findings of that sampling program, compares the results to those found in the mid-1970s, and reviews some of the major effects on the chemical water quality of the lake. After review of the earlier studies and discussion with regional and district Ministry of the Environment staff, the focus of the study was on the nutrient status of the lake.

In addition to surveys conducted by the Ministry of the Environment, the Ministry of Natural Resources, through its Lake Nipissing Fisheries Assessment Unit, conducts regular creel censuses to assess the status of the lake's fisheries.

There is no evidence of stress on the lake due to the input of heavy metals or toxic organic compounds. Evidence of significant sources of these pollutants is usually manifested through elevated levels of these compounds in fish. Several fish species from the lake (white bass, yellow perch, northern pike, walleye, brown

bullhead, and smallmouth bass) have been analyzed for mercury, PCB's, mirex, and pesticides. Levels of all the compounds are very low to undetectable, and have resulted in minimal restrictions to the consumption of fish from the lake (Ministry of the Environment, 1990). Compared to many other lakes in the province, the levels of these pollutants are extremely low in Lake Nipissing fish.

Levels of plant nutrients, and in particular phosphorus, determine the trophic status of a lake. The term 'trophic' refers to the status of nutrition, and in reference to lakes, three broad classifications have emerged. Oligotrophic refers to lakes with low levels of nutrients, and is typified by deeper lakes with very clear water, and low densities of aquatic plants. Eutrophic refers to lakes with high levels of nutrients, and these lakes are typically shallower lakes with low water clarity, caused by high levels of algae. Eutrophic lakes typically have large areas covered by aquatic plants. Mesotrophic lakes are lakes with water clarity and plant densities between these extremes. Most lakes naturally progress over long periods from oligotrophic to more eutrophic conditions.

Human activities such as shoreline development, land clearing and disturbance can increase the rate of sedimentation in a lake, creating more suitable habitat for aquatic plant growth. Addition of nutrients through sewage treatment plant effluents, and migration of nutrients from septic fields can add significantly to the nutrient concentration in inland lakes. Agricultural activities usually have the greatest impact. Crop fertilization, feedlot runoff, and manure slurry application can all increase concentrations of dissolved nutrients, while some tillage practices can significantly increase erosion. Access of livestock to streams and rivers can increase both bank and streambed erosion and increase nutrient and bacterial levels through direct input of faeces. Any or all of these mechanisms can accelerate the eutrophication process significantly.

In Ontario lakes, phosphorus is almost always the nutrient which determines the degree of algae growth (Dillon and Rigler, 1975). Phosphorus is essential for the normal functioning of lakes, and certain levels are required for the primary

production of food upon which the remainder of the aquatic food web depends. Too much phosphorus, however, can lead to undesirable conditions. Algae blooms can cause disagreeable conditions for virtually any type of water-based recreation. After algae complete their life cycle, algal remains settle to the bottom of a lake, and decompose through microbial action in a process which consumes oxygen. Low levels of oxygen can have an adverse effect on fish populations, as well as other aquatic organisms.

Excess algae production can also contribute to aquatic plant growth, particularly in sheltered areas of a lake. Algae settling out of the water column can enrich sediments with organic carbon, phosphorus, nitrogen, and other nutrients. These enriched sediment conditions can favour the growth of macrophytes (rooted aquatic plants). Aquatic plants are essential for various life stages of many species of fish, and play a major role in the functioning of warmwater lake ecosystems. However, extensive and dense stands of aquatic weeds can interfere with several types of water-based recreation, including swimming and boating.

In extreme cases of eutrophication, algae densities can be sufficiently high to restrict the growth of aquatic plants. The mechanism for this restriction is shading, with high algae densities blocking light to a degree where the depth at which aquatic plants can grow is restricted.

The earlier surveys of Lake Nipissing showed that the lake was very productive, with high levels of nutrients compared to other lakes in the area. In part, this is a natural phenomenon, since Lake Nipissing is in the sedimentary basin of a large glacial lake. The current study was directed at updating the nutrient status of the lake to estimate the impact of urban and agricultural drainage.

1. (a) Physical Characteristics of the Lake

Despite its very large surface area, Lake Nipissing is quite shallow (see Figure 1). Except for an area close to the outflow, the lake is less than 20 metres deep. With

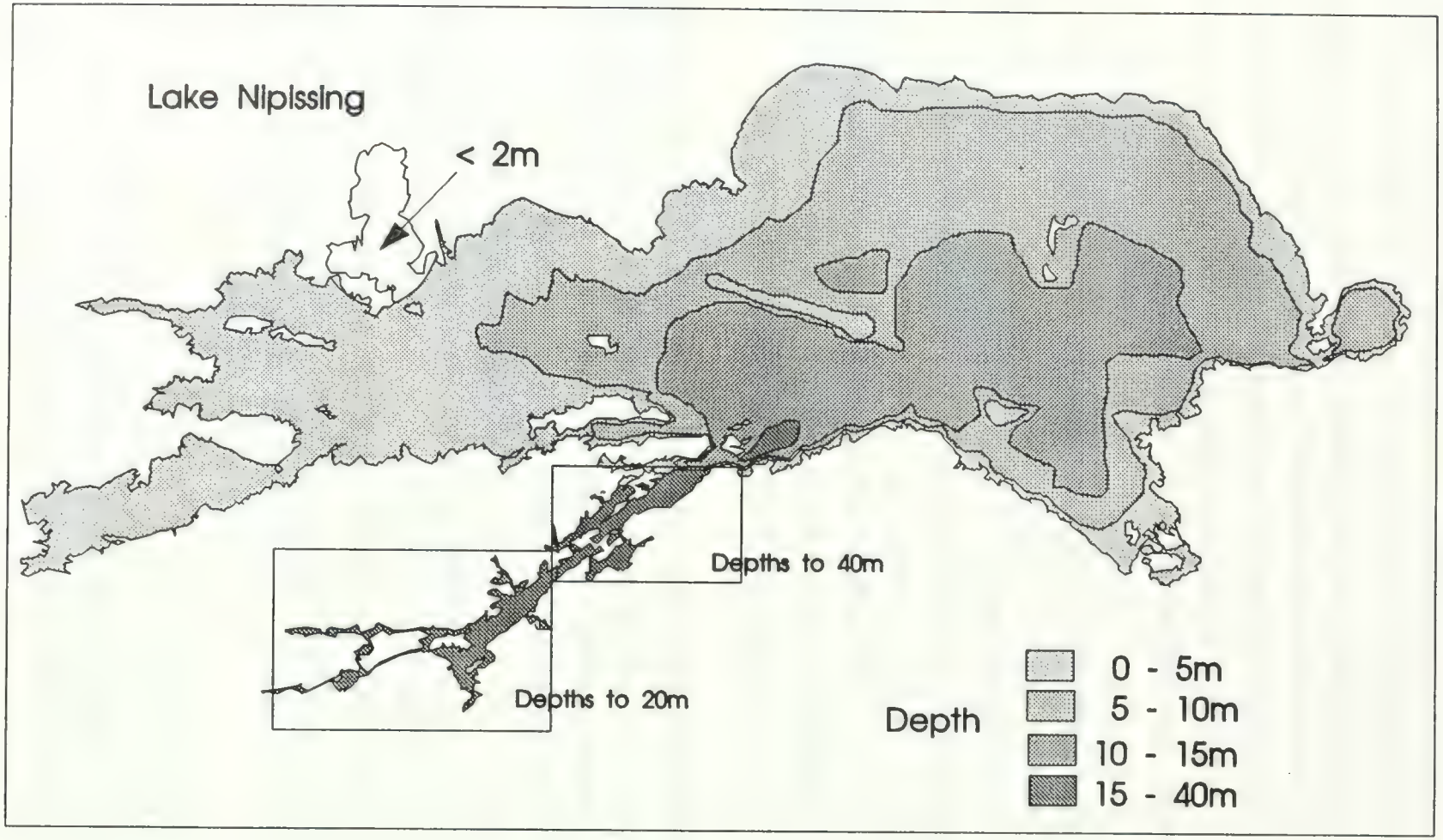

Figure 1: Approximate water depth

its very large fetch (a measure of the continuous extent of a lake exposed to wind), Lake Nipissing's surface waters are mixed by waves and wind to a substantial depth. As will be described later, this has a very beneficial effect. The lake has some enclosed embayments, and two of these (Cache Bay and Callander Bay) have water quality which is quite distinct from the main body of the lake.

1. (b) The Lake Nipissing Watershed

Lake Nipissing is a remnant of glacial Lake Algonquin. The lake lies in an area of Precambrian bedrock, covered over large areas by extensive deposits of glacial sands and clays. The watershed of Lake Nipissing is made up of drainage from twelve inflows. The largest of these is the Sturgeon River, with the Amateewakea, South, and Veuve rivers also being major inflows. In addition to the eight smaller inflows, there are many smaller creeks which flow into the lake. The major inflows

Table I: Major Inflows to Lake Nipissing

Inflow	Drainage Area (ha)
Sturgeon	489000
Little Sturgeon	76000
Duchesnay	36000
La Vase	43000
Wistiwasing	58000
Boleau and Bear	44700
South	147000
Bass	51000
Amateewakea	169000
Macpherson	50000
Veuve	127000
Cache	20500

and their approximate drainage area are given in Table I. The location of the

inflows, and a crude map showing cleared areas (as shown on 1:50000 maps) in the immediate watershed are shown as Figures 2a) and b). In addition to the agriculture in the Cache and Veuve River watersheds, there is considerable agricultural activity in the Wistiwasing River and La Vase watersheds. Drainage from the urbanised area around North Bay occurs primarily through a series of small creeks, of which Chippewa Creek is the largest.

1. (c) Sampling Regime

The lake was sampled at 26 sites (Figure 3 and Table II). The sampling locations were selected with two criteria in mind: coincidence with sampling stations used in the 1975 assessment, and representation of areas of the lake felt to be distinct; for example, embayments or areas close to point sources of nutrients such as the North Bay sewage treatment plant diffuser. Sampling was attempted monthly during the ice-free season, and once during ice cover (March, 1990). On some occasions, weather conditions prevented sampling, but each site was visited a total of seventeen times. The sampling under ice cover was conducted primarily to determine whether oxygen depletion of the water column was occurring. The only deep station was Station 12, (Campbell's Point, 40 m deep). Based on experience with the previous sampling, this was felt to be the only station which would stratify. Water temperature profiles were recorded to verify this observation. Vertical oxygen profiles were measured at station 12 for each of the sampling runs. The oxygen concentrations measured at Station 12 are discussed separately in the second section of the report.

A three-year sampling program was conducted to determine average conditions for the lake. It was felt that any single year of intensive sampling may not be representative of long-term average conditions, but that sampling over a three year period would provide information on annual variability caused by weather or flow conditions.

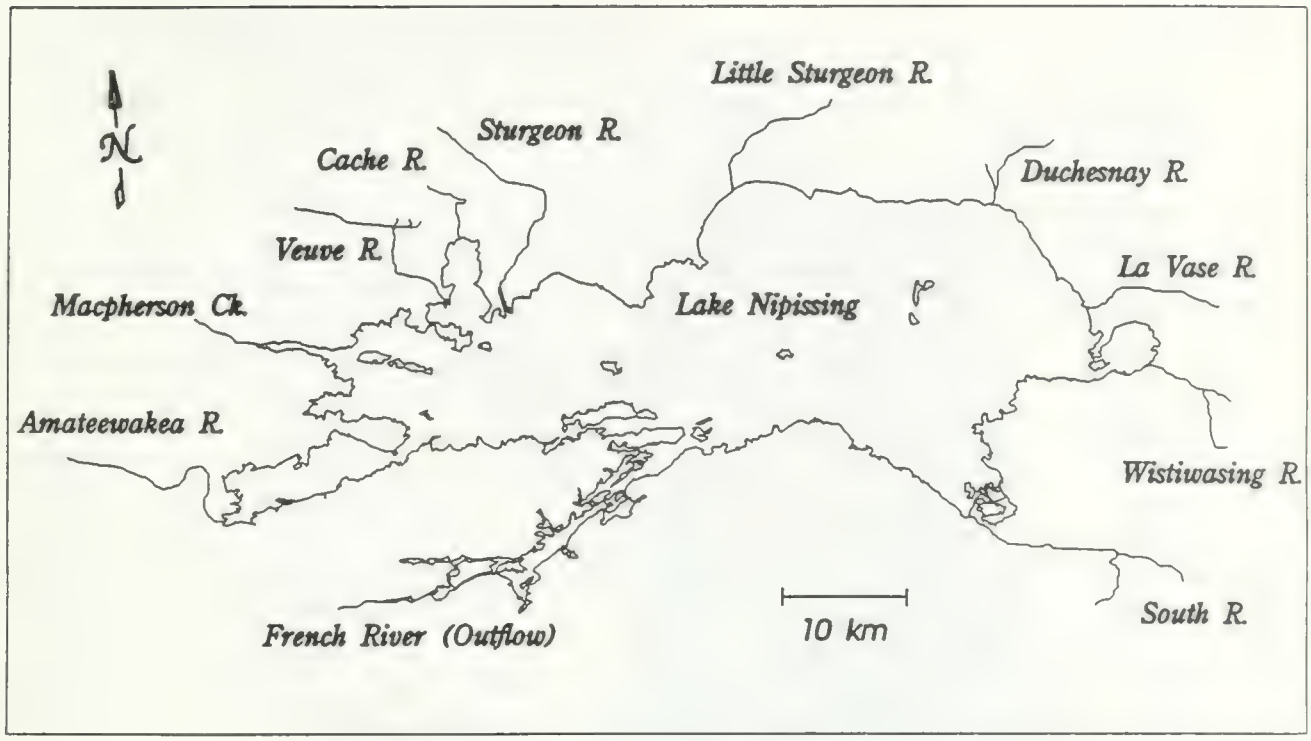

Figure 2a): Major inflows to Lake Nipissing

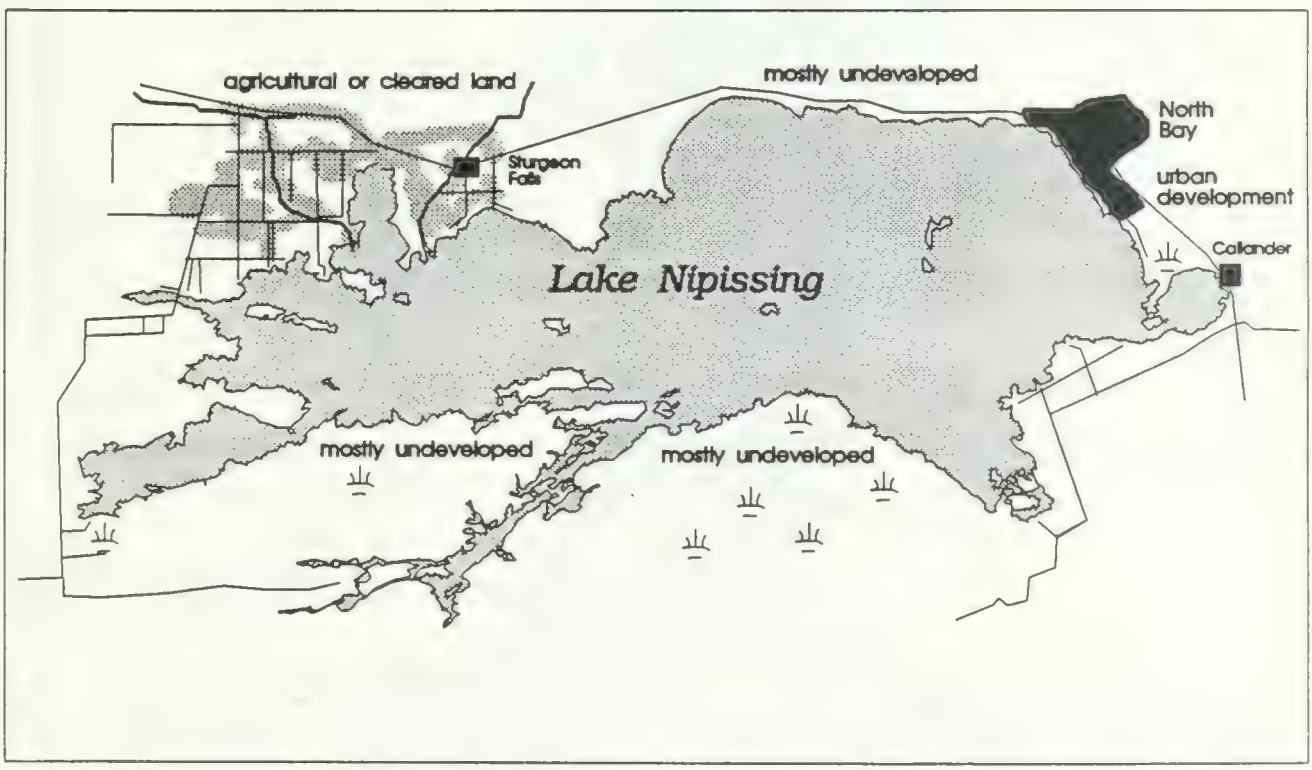

Figure 2b): Land use in the immediate watershed

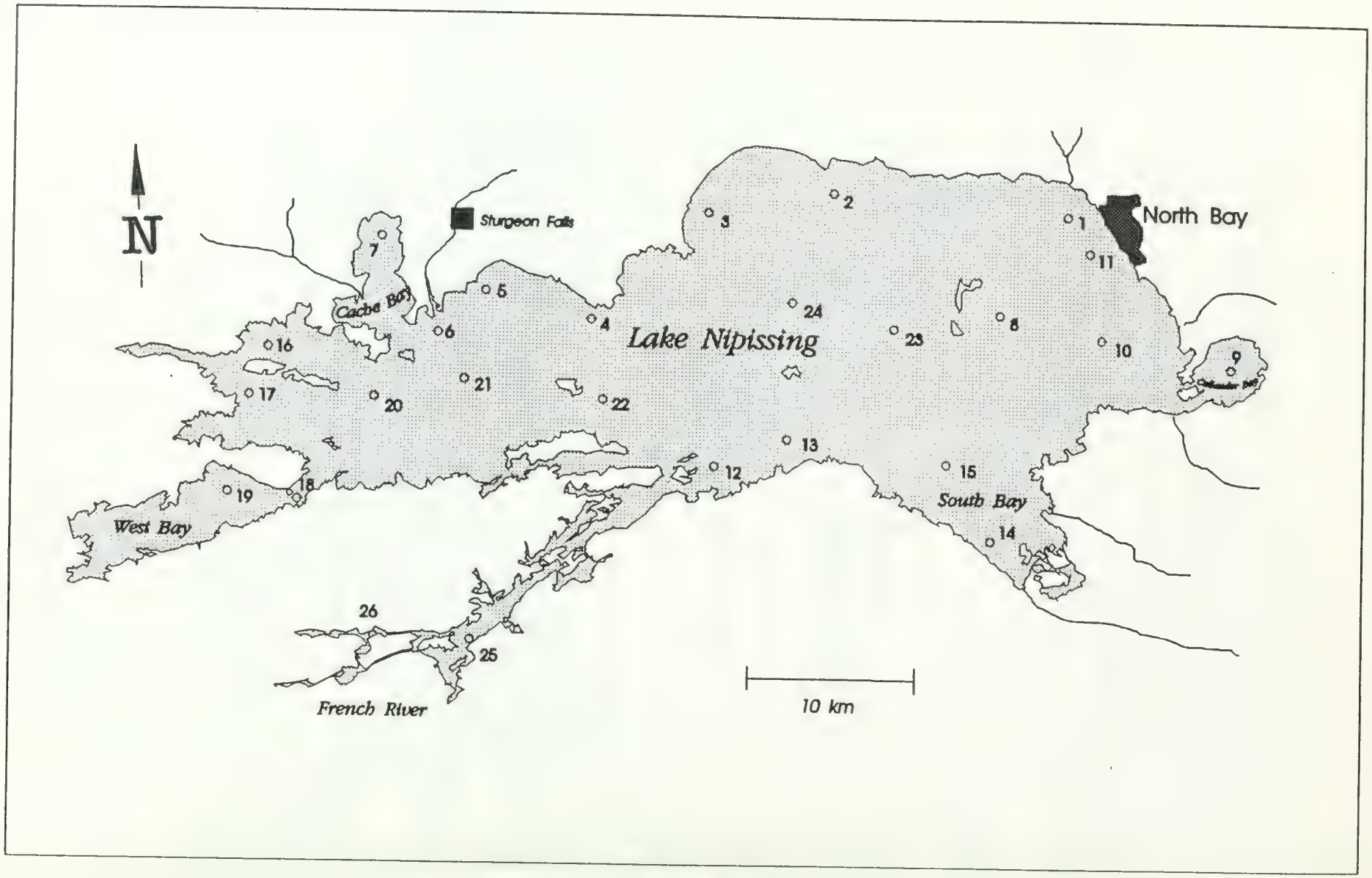

Figure 3: Sampling locations

Table II: Location of Sampling Stations

Station	Name	Location*		1975 Equivalent
1	Yellek Point	615000	5130400	N1
2	Beaucage Point	607300	5132800	N2
3	Meadowside	595600	5133000	N3
4	Dokis Point	586300	5127100	N4
5	Mouseau Point	582900	5130000	N5
6	Sturgeon River	579000	5129000	N6
7	Cache Bay	576600	5134700	N7
8	Manitou Island East	613000	5125000	E23
9	Callander Bay	576800	5133400	E24
10	Second Rocky Point	616300	5121900	E25
11	North Bay Diffuser	616000	5128000	-
12	Campbell's Point	593400	5118000	S16
13	Cross Point	598200	5118700	S14
14	Jessop Island West	609400	5110000	S19
15	South Bay, Durrell Pt.	605800	5115800	S20
16	Hardwood Island North	568800	5115800	W9
17	Gull Island East	564700	5121100	W10
18	Hay Narrows	570000	5121200	W11
19	West Bay	564800	5121000	W12
20	Little Oak Island South	575200	5125700	C8
21	Iron Island West	580000	5125100	C14
22	Iron Island East	589000	5124000	C15
23	Manitou Island West	603400	5123000	C21
24	Burritt Island South	598900	5125900	C22
25	Chaudiere Dam	577000	5108000	F1
26	Little Chaudiere Dam	576400	5110400	F2

* location is given in UTM coordinates, zone 17.

1. (d) Methods

All samples were water column composites taken from 0 to 5 m or to within 1 m of the bottom in the case of shallow stations. Major ions and nutrients were analyzed at BEAK analytical laboratories in Toronto using standard methods

outlined in Ontario Ministry of the Environment (1981). Extensive quality control procedures were in place to ensure the comparability of BEAK results with results produced at the Ministry of the Environment labs. Oxygen profile samples at station 12 and all chlorophyll samples were analyzed at the Ministry of the Environment laboratory at Dorset. Iron and manganese were analyzed at the Ministry of the Environment laboratory in Rexdale.

2. Chemical Water Quality

The data are presented in three different ways. Several parameters (for example calcium and sodium), showed little temporal variation but varied spatially. These data are presented as maps showing the three-year average for the parameter across the lake. Other parameters, particularly those associated with nutrients and lake productivity, showed significant seasonal variability. These data are presented as monthly maps, showing the three-year average spatial and seasonal variation. All raw, monthly, and annually averaged data are listed in the appendices to the report.

2. (a) Major Ions

The major cations (positively charged ions) in solution in Ontario lakes are: calcium, magnesium, sodium, and potassium. Calcium is usually the major cation, and dominates a lake's conductivity (the capacity to conduct electrical current). Figures 4a and b show the spatial variation in calcium and conductivity in Lake Nipissing. In both cases, the Cache Bay area of the lake showed the highest values, while West Bay showed the lowest. There is also an area of slightly elevated conductivity in the northeasterly portion of the lake. This is probably associated with road salt runoff. Figures 5a and b show the concentration of sodium and chloride, the constituents of road salt. The portion of the lake around Callander Bay and the far eastern end of the lake clearly show evidence of road

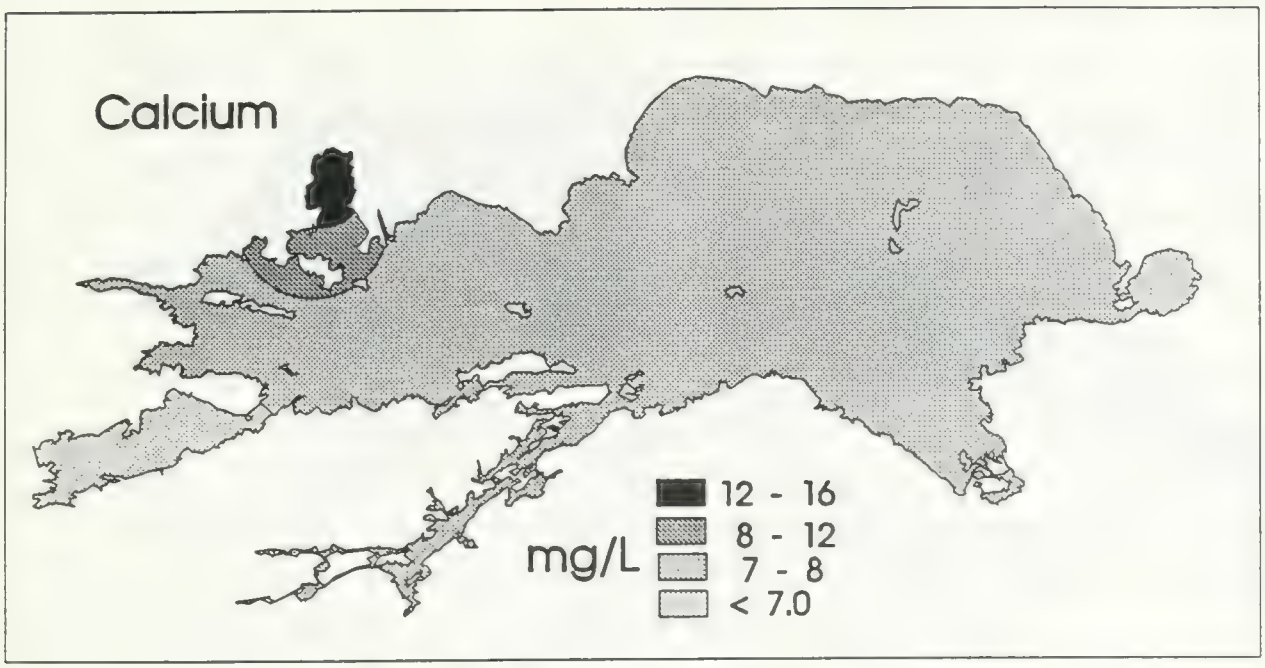

Figure 4a): Three-year mean calcium concentration

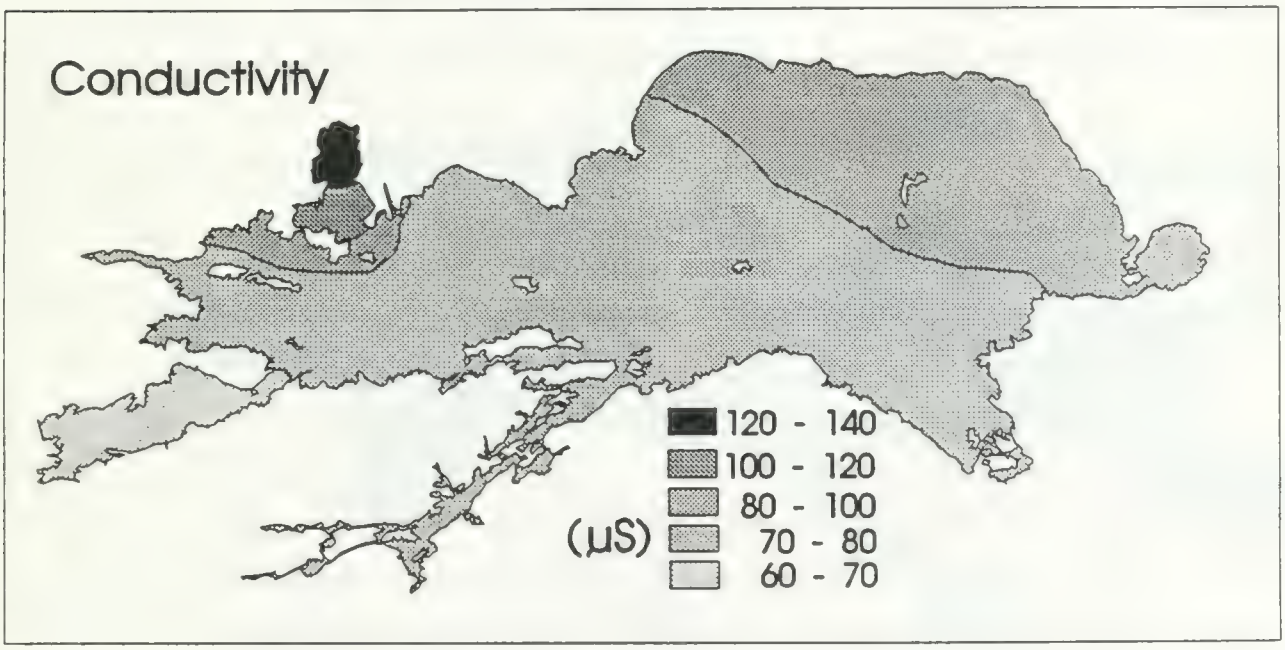

Figure 4b): Three-year mean conductivity

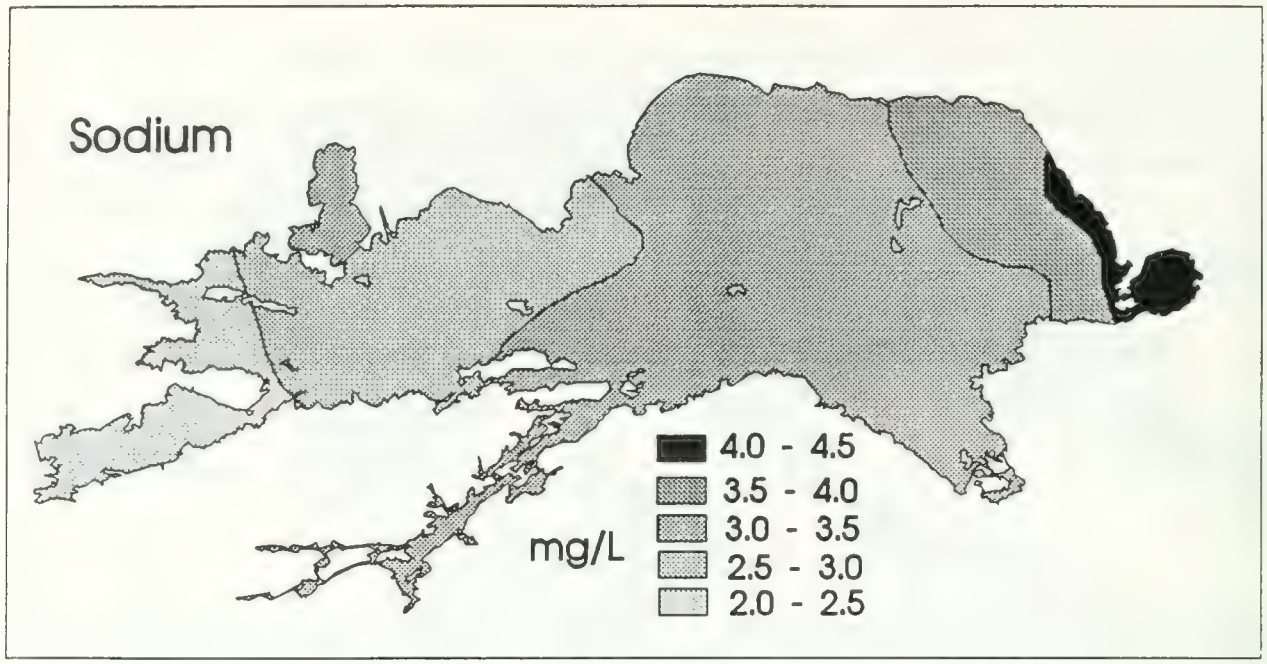

Figure 5a): Three-year mean sodium concentration

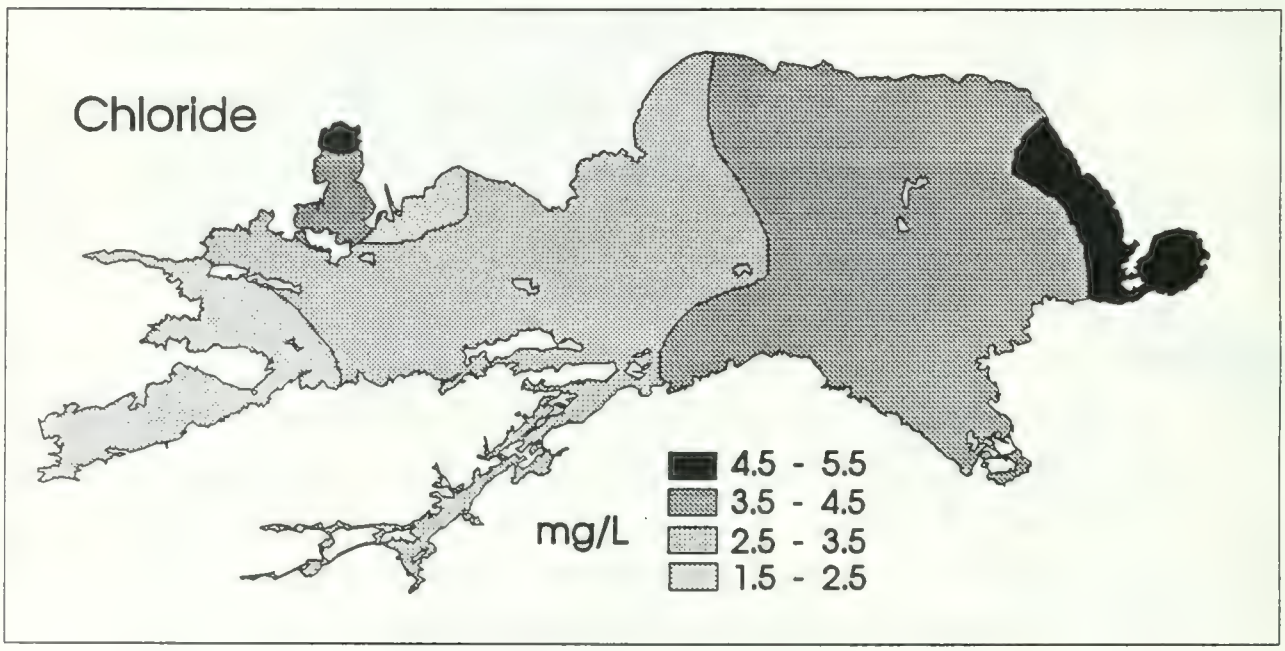

Figure 5b): Three-year mean chloride concentration

salt input. While this is a result of anthropogenic activities, there are no known adverse effects of salt enrichment at these levels. Toxic effects of high concentrations of chloride have been reported for several freshwater aquatic organisms, but the lowest recorded level of adverse impact is ten to twenty times the concentrations seen in the eastern end of Lake Nipissing.

Consistent with the relatively high calcium levels in the lake, the pH and alkalinity of the lake are also high (see Figures 6a and b). The lake is neutral to slightly basic. The higher levels in the Cache Bay area of the lake are associated with bicarbonate production in the highly productive macrophyte (aquatic plant) beds in that portion of the lake in addition to the elevated calcium levels being contributed to that end of the lake through the Cache River.

Levels of the other major ions (magnesium, potassium, and sulphate) are not mapped, but the data are listed in the appendices. None of these ions are outside the range of values which would be considered typical of an Ontario lake.

2. (b) Nutrients and Related Measurements

There were major spatial and seasonal differences in the levels of plant nutrients found in the lake. Each of the major nutrients will be discussed separately.

2. (b) (i) Phosphorus

Phosphorus is the nutrient which most commonly influences the growth of algae in Ontario lakes. Enrichment of a lake with phosphorus causes increased algae growth, and this in turn has a major impact on the aesthetics of a lake. Excess algae production can result in unsightly algal blooms, taste and odour problems in the water, oxygen depletion in lakes which thermally stratify. The algal remains can, in addition, 'fertilize' the lake bottom and by enriching sediments, lead to excessive growth of aquatic plants.

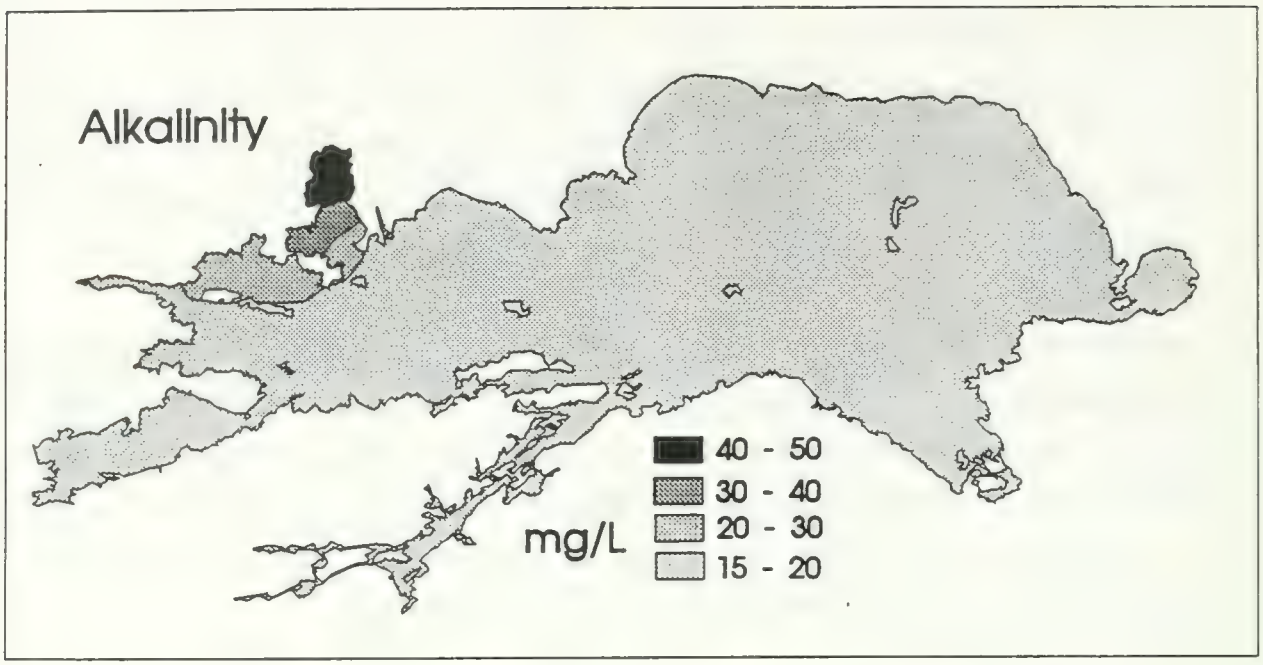

Figure 6a): Three-year mean alkalinity concentration

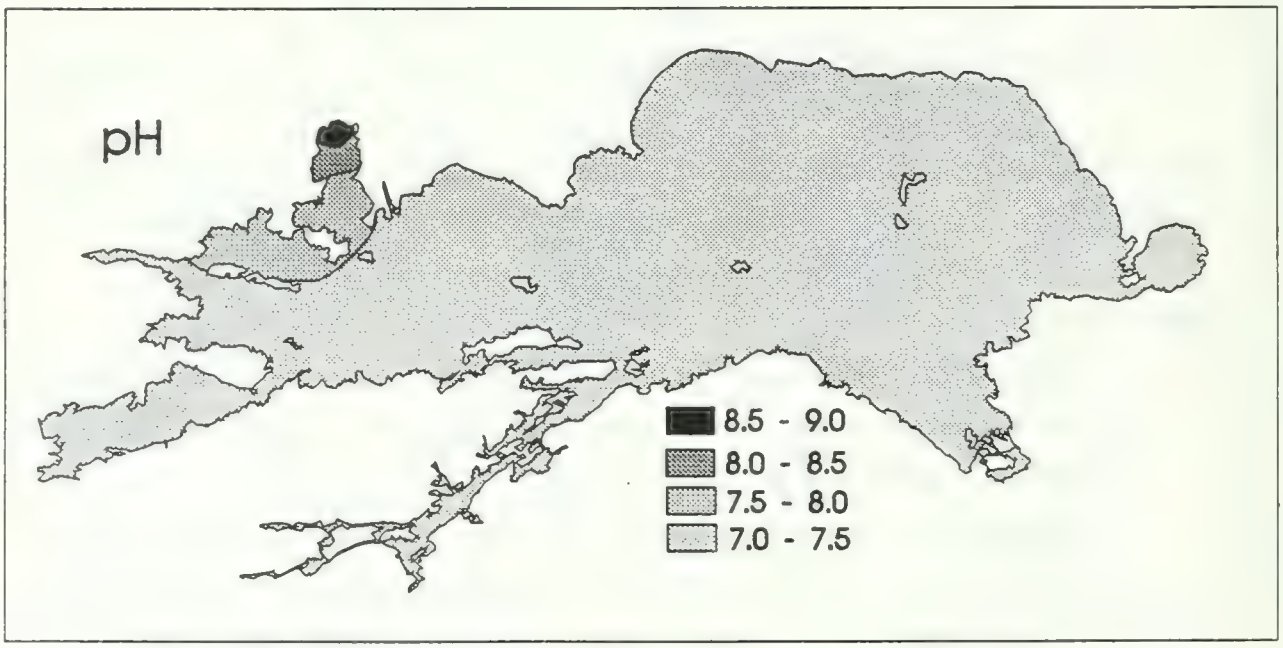

Figure 6b): Three-year mean pH

The phosphorus levels in Lake Nipissing indicate that the lake is mesotrophic. The spatial and temporal variation of phosphorus concentrations in Lake Nipissing are shown in Figure 7. In May, in most of the lake, the concentrations were in the 10-15 $\mu g.L^{-1}$ range. Callander Bay and the northwest end of the lake have higher concentrations. By mid summer, large portions of the lake had lower phosphorus concentrations, due to the uptake of available phosphorus by algae and subsequent loss from the water column. In August and September, the east end of the lake showed considerable phosphorus enrichment. By November, the highest concentrations are found in the Cache Bay/Hardwood Island portion of the lake. The most likely source of this phosphorus is the decay of the extensive macrophyte beds found in that portion of the lake.

2. (b) (ii) Nitrogen Compounds

Although they do not typically limit algal growth, nitrogen compounds are essential plant nutrients, and can influence the type of algae which dominate a lake. Figure 8 shows the distribution of inorganic nitrogen in the lake, and Figure 9 shows the distribution of organic nitrogen concentrations in the lake. The inorganic nitrogen concentrations show a general decline throughout the year. In May and June, enrichment associated with urban and agricultural runoff, as well as nitrogen contributed from the effluent from the North Bay sewage treatment plant is evident in the eastern portion of the lake. As the inorganic nitrogen decreases during the algal growing season, the total nitrogen component of the lake is dominated by organic nitrogen compounds.

Elevated inorganic nitrogen levels were found, particularly in the summer months, near North Bay and the STP diffuser. Since nitrate is a principal component of treated sewage effluent, these results are not surprising. These elevated levels are not as noticeable during the fall months, presumably due to dilution through wind mixing. At no time did the nitrate

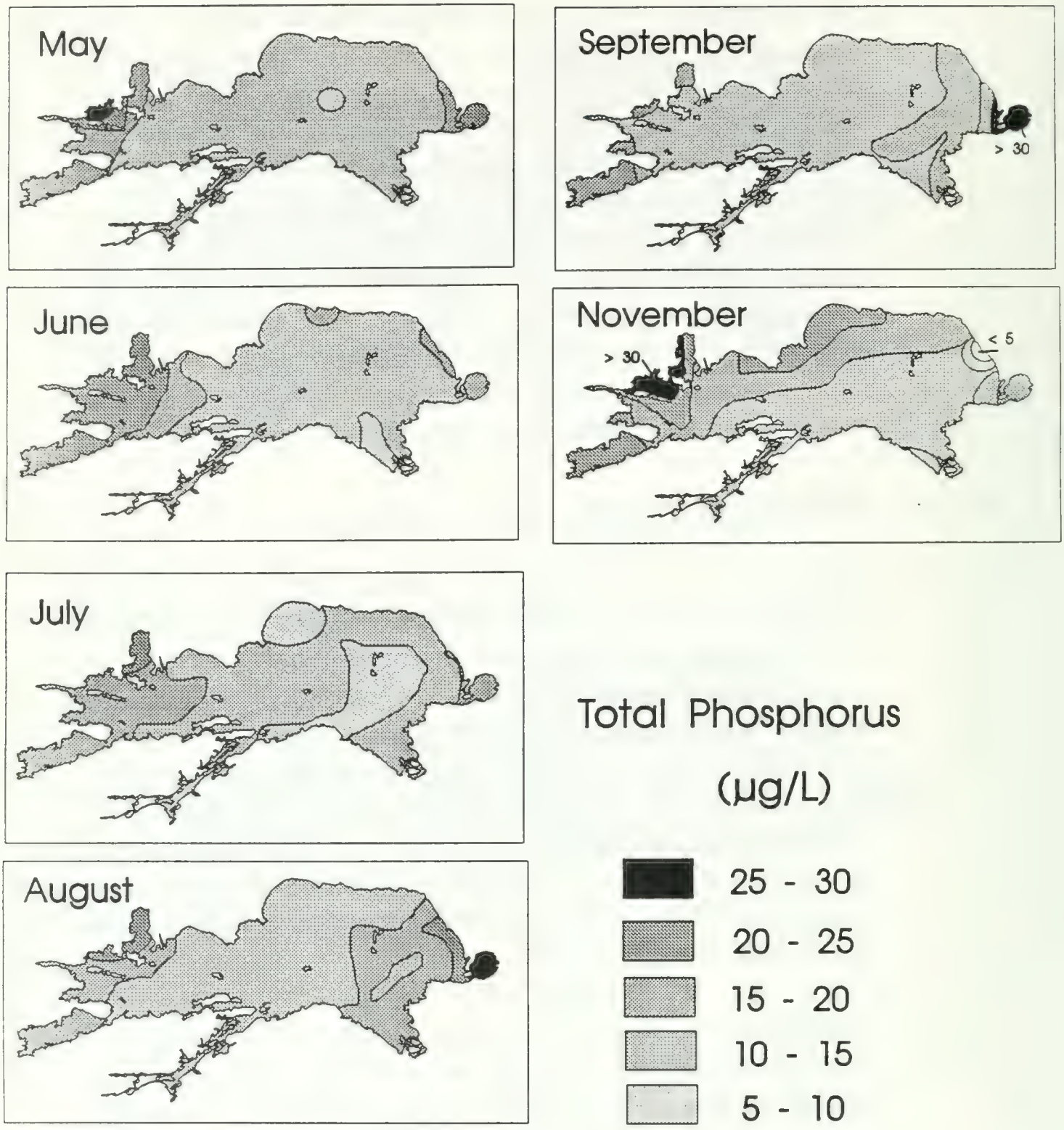

Figure 7: Three-year mean seasonal variation in phosphorus concentration

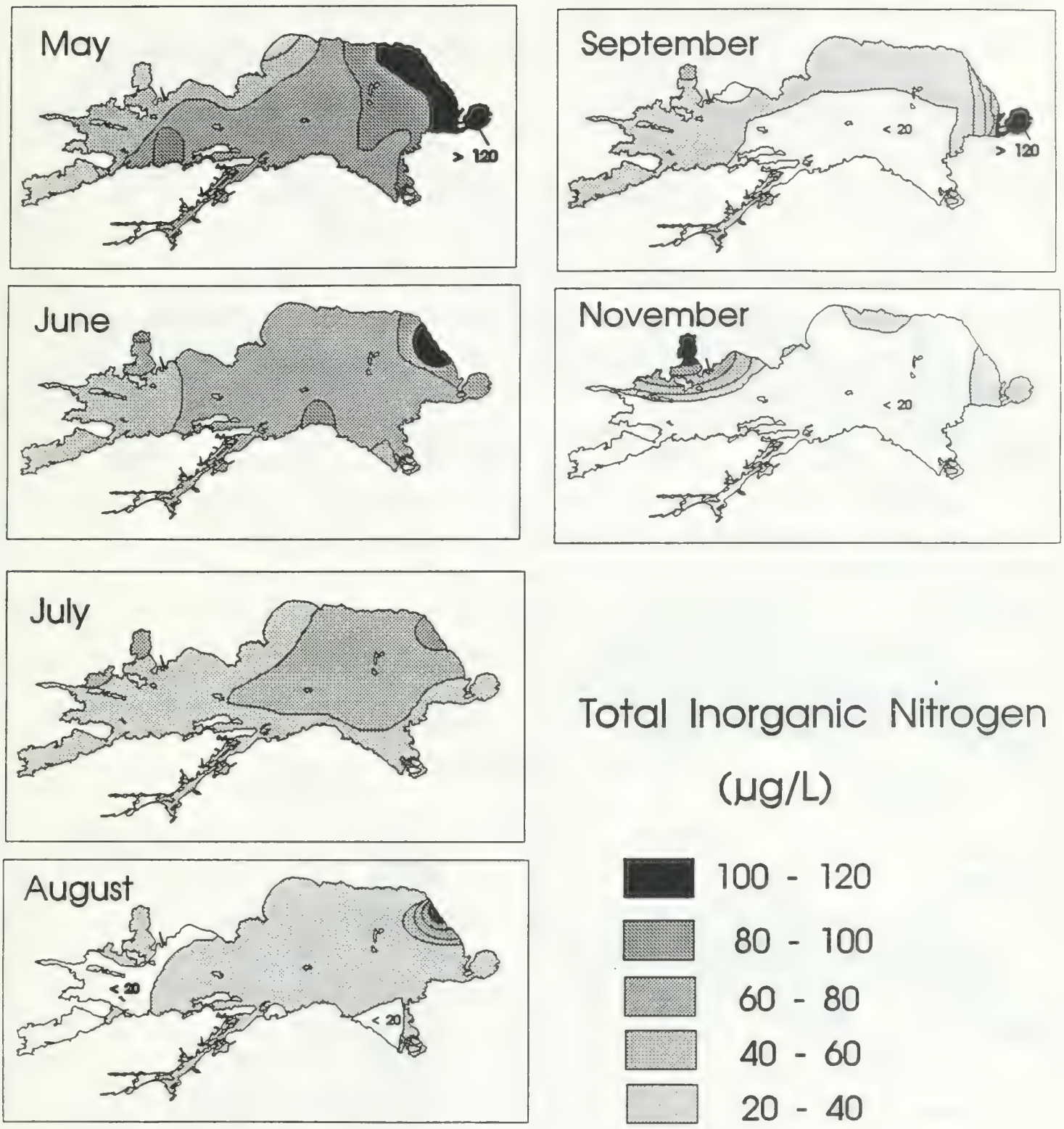

Figure 8: Three-year mean seasonal variation in total inorganic nitrogen concentration

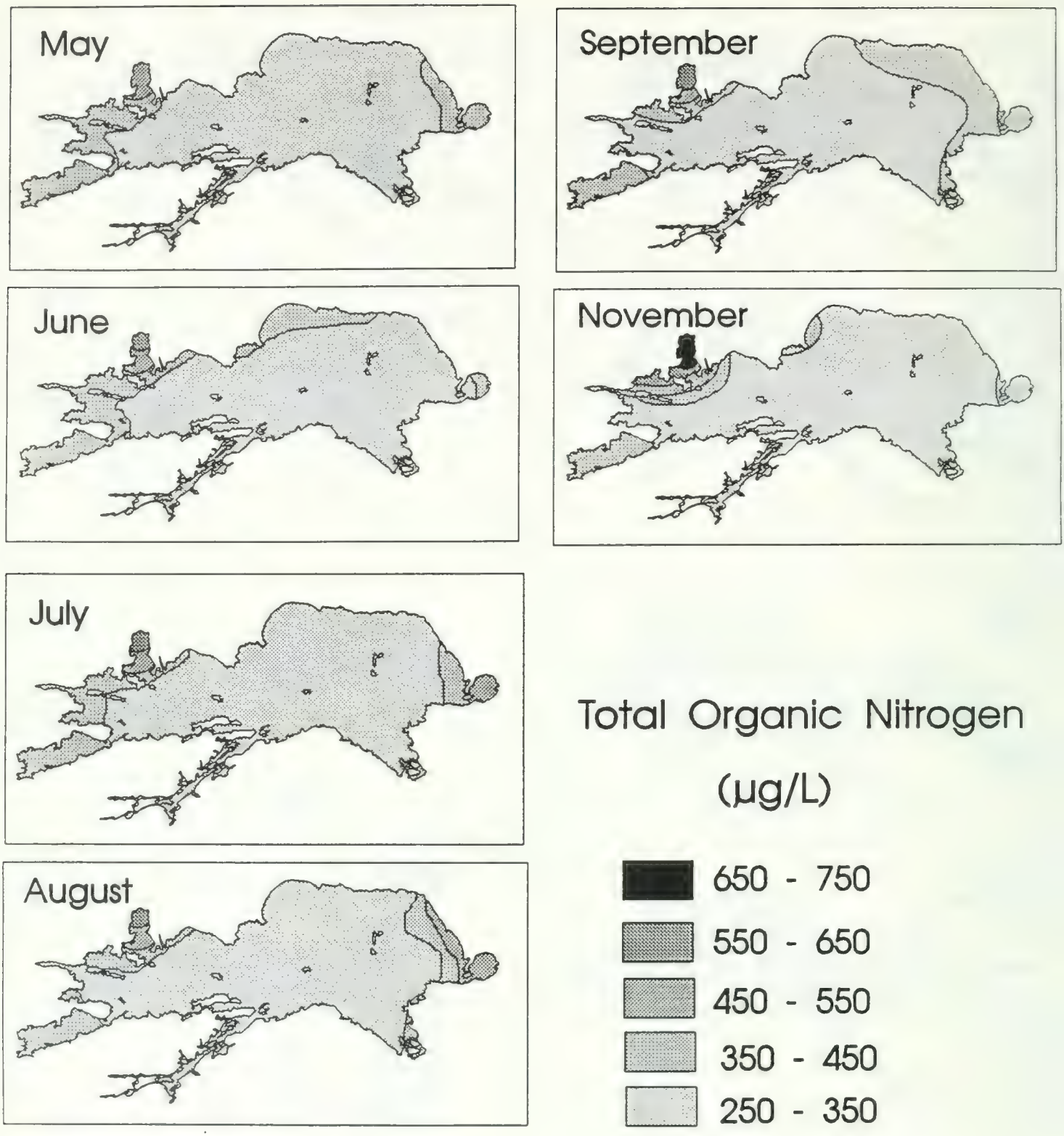

Figure 9: Three-year mean seasonal variation in total organic nitrogen concentration

levels exceed (or approach) the Provincial Water Quality Objective of 10 $mg.L^{-1}$.

2. (b) (iii) Chlorophyll a

Chlorophyll a is the principal plant pigment used in photosynthesis, and is responsible for the green coloration in most plants. In water, the concentration of chlorophyll a is a surrogate measure of the concentration of planktonic algae. As explained earlier, algal concentrations are determined by the availability of plant nutrients, particularly phosphorus. The seasonal concentrations of chlorophyll measured in Lake Nipissing during the year are shown in Figure 10. Relatively high chlorophyll concentrations (generally in excess of 5 $\mu g.L^{-1}$) are common in Cache Bay throughout the year. The highest concentrations of chlorophyll, however, are observed in Callander Bay. Algal bloom conditions, with concentrations in excess of 10 $\mu g.L^{-1}$ predominate in the Bay throughout July, August, and September. These concentrations of chlorophyll present aesthetic problems and render the waters of the bay less suitable for water-contact recreation. The lowest concentrations of chlorophyll were consistently measured in the vicinity of the Sturgeon River inflow. This is attributable to the high flow conditions near the Sturgeon River mouth.

2. (b) (iv) Secchi Depth

Secchi depth is a crude measure of water clarity. There are several factors which can affect the clarity of water, including dissolved or suspended humic substances, suspended sediments, and algal concentration. The spatial and seasonal distribution of Secchi depth in Lake Nipissing are shown in Figure 11. There is a marked difference in water transparency throughout the year. Given the concentration of chlorophyll in the water, the Secchi depth is too low for the algal concentration to explain the variation in the Secchi depth. The shallow depth of the lake, coupled with

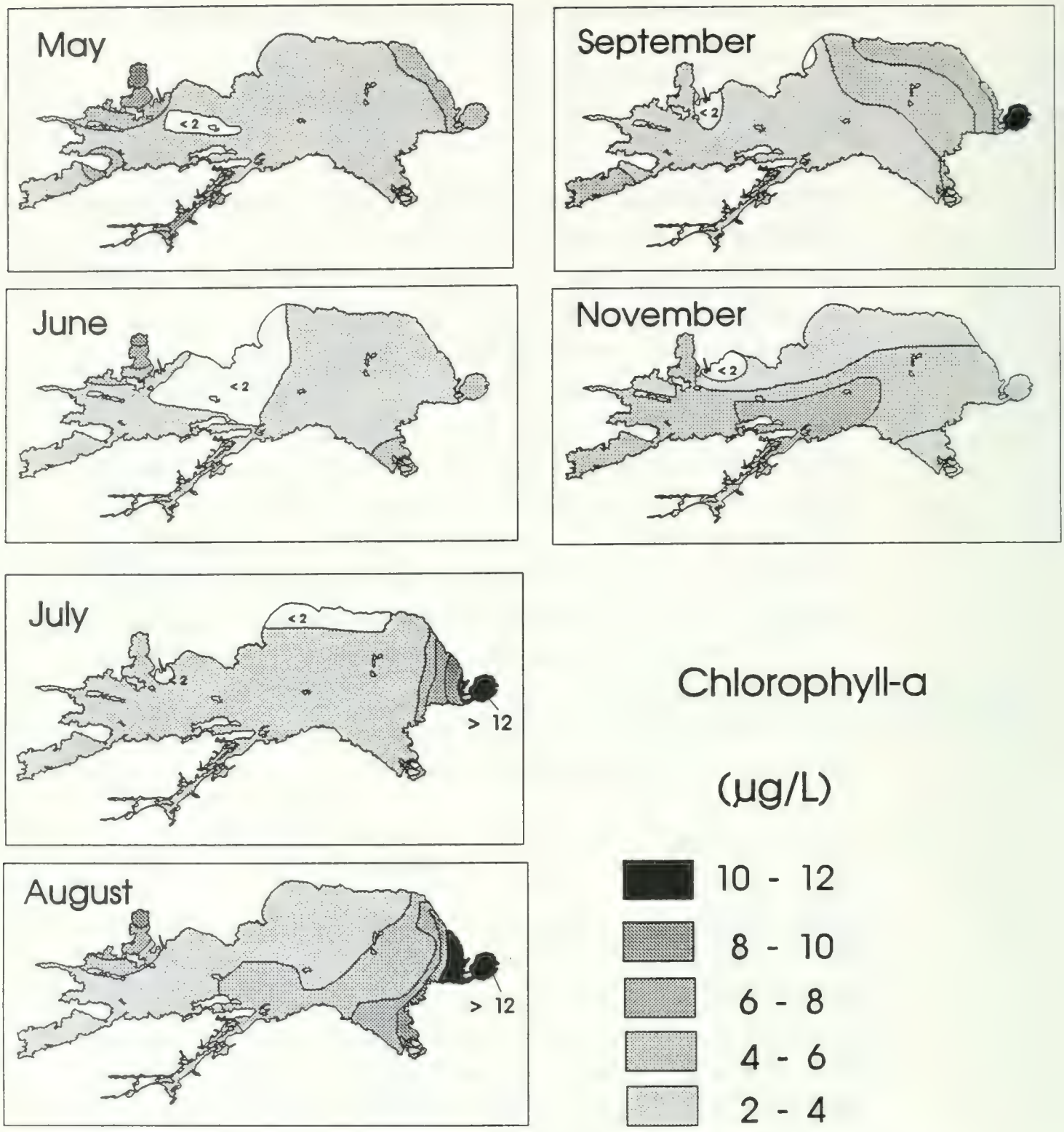

Figure 10: Three-year mean seasonal variation in chlorophyll-a concentration

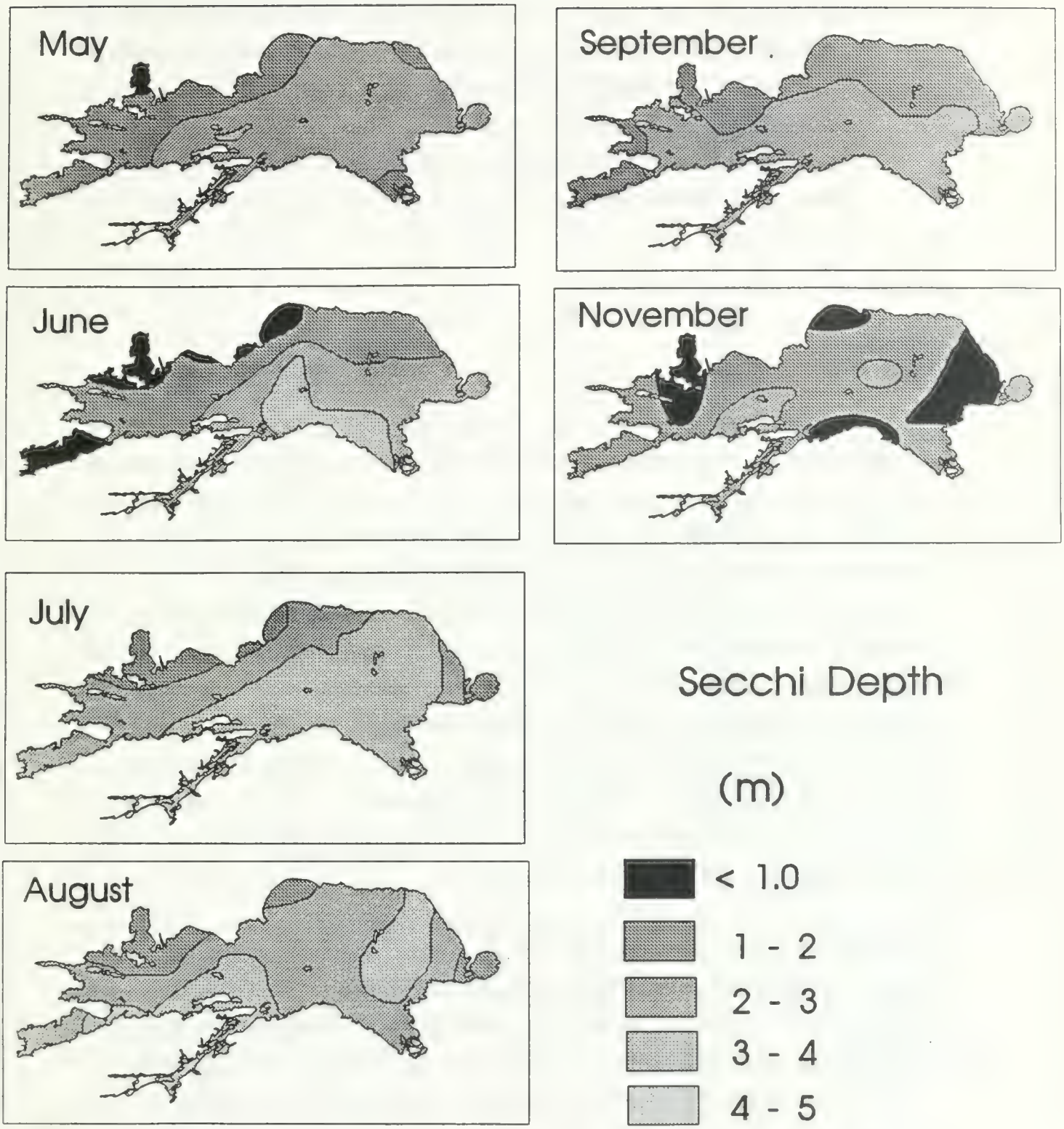

Figure 11: Three-year mean seasonal variation in secchi depth

its large fetch, allows wind mixing to the bottom. This turbulence suspends particulates from the bottom and contributes significantly to the turbidity of the water in the inshore area. The elevated chlorophyll concentrations in Cache and Callander Bays are responsible for the low water clarity in those areas. During fall sampling, particles of decaying plants from the extensive macrophyte beds in the western end of the lake also contributed to low water clarity.

2. (c) Oxygen

In productive lakes, algae and macrophytes can contribute large amounts of organic material to the sediments at the end of the summer. Bacteria decompose this material in a process which consumes oxygen. In very productive lakes, this process can result in the depletion of oxygen concentrations under the ice during the winter, as well as during the summer stratified period. The main source of oxygen to lakes is from the atmosphere, and during the ice-covered period, this source is effectively eliminated over most of the surface of the lake. There is, in addition, some algal and plant production in most lakes even under ice, and although photosynthesis by these can provide another source of daytime oxygen, plant and algal respiration can deplete oxygen at night. During March, 1990, a survey of the lake was conducted to determine the status of oxygen concentration under the ice. The results of the survey, shown in Table III, show that there is no sign of oxygen depletion in most of the lake.

There was only one sampling station in the lake which was deep enough to stratify. Station 12 (Campbell's Point) is situated near the French River outflow, and had a depth of 40 m. Lake conditions permitting, vertical oxygen profiles were measured at that station on each sampling run. The data for 1990 are shown in Figure 12. There is clear evidence of oxygen depletion at this site during the summer, as well as under ice. The site turns over each spring and fall, but the decay of organic matter causes a continual consumption of oxygen during the

Table III: Oxygen Concentrations Under Ice

Station	Station Depth(m)	Dissolved O_2 (ppm)	sample depth
1	4.5	15.0	3.0
2	5.0	15.2	3.0
3	2.5	13.2	2.0
4	4.0	14.1	3.0
5	2.8	11.3	2.0
6	2.0	13.5	1.0
7	1.2	10.7	0.8
8	12.0	13.3	5.0
9	9.5	13.2	5.0
10	6.0	15.4	5.0
11	5.0	17.2	4.0
12	40.0	------profile----------	
13	18.0	7.1	17.0
14	8.0	13.3	7.0
15	8.0	12.7	5.0
16	2.0	9.4	1.0
17	2.0	10.3	1.0
18	3.0	8.1	2.0
19	3.0	7.3	2.0
20	3.0	11.8	2.0
21	4.0	11.9	3.0
22	9.0	11.8	8.0
23	12.0	14.1	5.0
24	11.0	14.8	5.0
25*	16.0	10.2	1.0
26*	26.0	9.0	1.0

* open water sampling site

summer. This is to be expected given the mesotrophic nature of the lake, the large area of production in the lake, and the small volume of the stratified area. It is important to note that the area affected represents a tiny fraction of the total lake area.

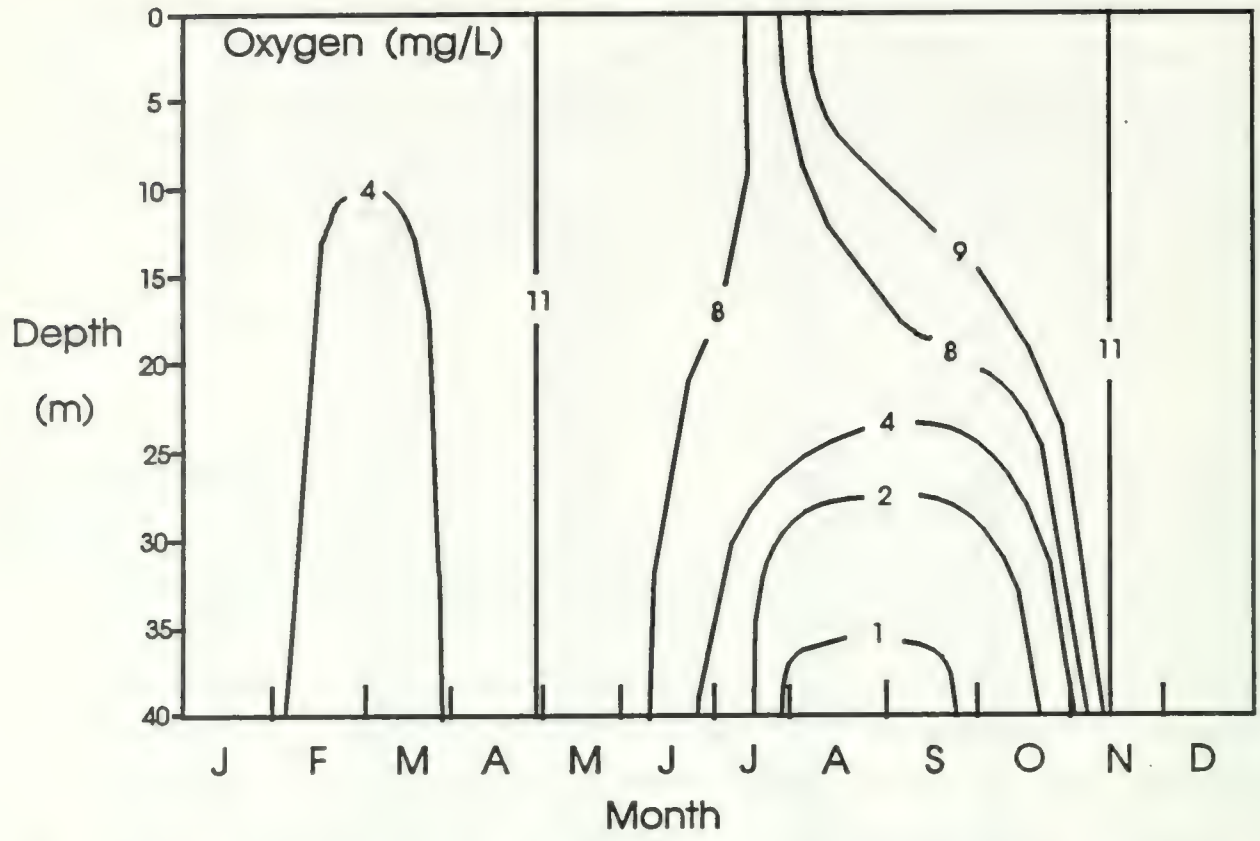

Figure 12: 1990 Oxygen Profiles at Station 12 (near the mouth of the French River)

2. (d) Beach Debris

Concern about accumulations of algae and other material on the beaches near North Bay have also been expressed to the North Bay District Ministry of the Environment office (B. Mason, pers. comm.). At a public meeting in April, 1990, on the status of Lake Nipissing, samples of beach debris were submitted to the Ministry of the Environment for analysis. This material was ashed, and found to be organic. Microscopic examination of the material revealed that it was primarily small fragments of wood and aquatic plants, mixed with small amounts of charcoal. The partially decomposed aquatic plant remains are no surprise. There are extensive beds of aquatic plants in the lake which decompose over winter. Since the vast majority of the lake mixes to the bottom, it is to be expected that at least

some of this material will be resuspended. The charcoal may be the result of fires lit on the lake in ice huts, or it may be washed in from the beaches. It is difficult to determine the source of the woody debris.

The accumulation of this organic material on the beaches near North Bay is the result of the extremely large fetch of the lake, the location of the beaches in relation to the long axis of the lake, and the direction of the prevailing winds during the ice-free period. All of these factors result in the accumulation of considerable amounts of debris on these beaches. The same factors can result in the buildup of algae on the beaches and in the near-shore areas around North Bay.

3. Comparison With Earlier Surveys

One of the purposes of this survey was to evaluate the data collected in the earlier surveys. As explained earlier, the focus of the study was to evaluate the lake with respect to trophic status. Comparisons with data collected between 1971-1974 and our data, collected between 1988 and 1990 were conducted for the two parameters most indicative of trophic status: phosphorus and chlorophyll. The data for August were selected since they had the most current and historical data for comparison. The results are shown in Tables IV and V. There are problems with the intercomparison. The data suggest that there has been a significant decrease in phosphorus concentration and an increase in chlorophyll concentration. This **can** happen, but it is unlikely. Theoretically, these results could occur if there has been a dramatic alteration in the structure of the food web of the lake, but a recent evaluation of the fisheries of the lake indicates that the structure of the fishery has been fairly stable since 1970 (Jorgensen, 1990).

Changes in analytical methods are a much more likely source of variation. Both phosphorus and chlorophyll analytical methodology have changed over the past fifteen years. In the case of chlorophyll, glass fibre filters have been replaced with membrane filters to separate algal cells from the sampled water. These membrane

Table IV: Comparison between 1988-90 and 1971-75 August Chlorophyll Data

Station	1988-90* Average	1971-75 Average	Difference
1	3.8	2.9	0.9
2	3.8	2.1	1.6
3	2.5	2.1	0.4
4	3.4	2.5	0.9
5	2.2	2.0	0.2
6	1.9	1.7	0.2
7	8.0	13.6	-5.6
8	4.1	0.8	3.3
9	24.2	20.0	4.2
10	4.5	4.8	-0.3
11	7.3	3.7	3.6
12	4.4	3.0	1.4
13	3.9	2.4	1.5
14	7.0	3.2	3.8
15	6.1	3.2	2.9
16	6.3	2.3	4.0
17	2.7	1.3	1.4
18	2.7	4.1	-1.4
19	3.8	2.1	1.7
20	2.4	2.8	-0.4
21	3.2	1.9	1.3
22	4.2	2.8	1.4
23	3.4	2.6	0.8
24	3.9	2.4	1.5

* all concentrations are $\mu g.L^{-1}$ total chlorophyll-a

filters are more efficient and less susceptible to interference than the glass fibre filters, but tend to yield higher chlorophyll results. The phosphorus method has also changed. Experience at the Dorset Research Centre indicates that results obtained before 1981 tend to be unreliable. For example, data collected at Harp Lake (near Huntsville) between 1972 and 1974 recorded phosphorus levels of 10-15 $\mu g.L^{-1}$. Over ten years of intensive sampling, using newer analytical methods, levels 10 $\mu g.L^{-1}$ have never been recorded. The strong implication, confirmed by

Table V: Comparison between 1988-90 and 1971-75 August Phosphorus Data

Station	1988-90* Average	1971-75 Average	Difference
1	10.9	26.0	-15.1
2	13.4	16.5	-3.1
3	13.7	22.0	-8.3
4	13.9	21.0	-7.1
5	14.3	32.0	-17.7
6	13.9	20.0	-6.1
7	33.3	57.0	-23.7
8	16.3	21.0	-4.7
9	26.3	51.0	-24.7
10	14.2	22.5	-8.3
11	21.8	29.0	-7.2
12	14.3	23.5	-9.2
13	14.3	22.0	-7.7
14	16.9	23.5	-6.6
15	15.0	25.5	-10.5
16	21.5	20.0	1.5
17	15.7	19.0	-3.3
18	14.2	18.0	-3.8
19	15.8	22.0	-6.2
20	14.1	22.5	-8.4
21	12.6	23.5	-10.9
22	13.9	23.0	-9.1
23	15.0	26.0	-11.0
24	13.2	20.0	-6.8

* all concentrations are $\mu g.L^{-1}$ total phosphorus

laboratory intercomparisons between the older and newer phosphorus methods, is that the earlier phosphorus data overestimate phosphorus significantly.

These changes in analytical methods render comparison with the earlier results problematic. It is not possible with the available data to state conclusively whether there has been a significant change, either deterioration or improvement, in the trophic status of Lake Nipissing since the mid-1970s. Techniques such as paleolimnology or analysis of older remotely sensed images of the lake may

provide alternatives to explore that question. Based on an evaluation of the available data, it is highly unlikely that there has been a significant change in the trophic status of the lake over the past fifteen years.

4. Discussion

The concentration of calcium in Lake Nipissing is of particular interest from two standpoints: lake acidification, and the probability of zebra mussel invasion. Higher levels of calcium are usually associated with high levels of bicarbonate alkalinity. High levels of alkalinity represent the acid neutralizing capacity of a lake. Lake Nipissing is situated relatively close to a major source of sulphur deposition, Sudbury, which has resulted in widespread regional lake acidification in Ontario (Pitblado et al., 1980). Sufficient calcium and its associated anion bicarbonate, the principle component of alkalinity, 'protect' a lake against acidification. The maps of calcium (Figure 4a), alkalinity (Figure 5a) and pH (Figure 5b) show that Lake Nipissing is well buffered against acidification. The pH of Lake Nipissing varies from neutral to slightly basic, and is well above that of any recorded adverse effect of lake acidification.

High levels of calcium, however, can make a lake susceptible to another environmental problem. A recent invader of the Great Lakes in Ontario, the zebra mussel (*Dreissena polymorpha*) has presented severe problems in areas where it has colonized in high densities. Since this organism is new to Ontario, its exact environmental requirements for survival and proliferation are uncertain. Experimental studies in Europe indicate that a minimum of 12 $mg.L^{-1}$ calcium are needed for the survival of the larval stage of the mussel (Sprung, 1987). Surveys of its invasion of European lakes show that it is absent from lakes with less than 28 $mg.L^{-1}$ calcium (Ramcharan et al., 1991). Based on these figures, Lake Nipissing is unlikely to be successfully invaded. Only the Cache Bay area of the lake has calcium concentrations in excess of 12 $mg.L^{-1}$. Unless the zebra mussel

shows considerable capability to adapt to lower calcium levels, Lake Nipissing will likely be spared.

Lake Nipissing has always been a productive lake, and as shown by the sampling for nutrients and related parameters, the majority of the lake appears to have nutrient concentrations suitable for a healthy warmwater fishery. The algae levels contribute to the productive fishery, and do not appear to be resulting in aesthetic problems or nuisance algae blooms over the majority of the lake. Of concern are two enclosed embayments on the lake: Callander Bay and Cache Bay. The tributaries flowing into these bays drain areas of agricultural activity, which undoubtedly contribute to the eutrophic conditions in these embayments.

The results of the dissolved oxygen survey show that Lake Nipissing is well oxygenated throughout the year, with the exception of a small area of deep water near the mouth of the French River. It is likely that oxygen depletion of this area occurred historically, since there is such a large volume of productive water which can contribute organic material to the small stratified area. Oxygen depletion in this area was noted in surveys conducted in 1934 and 1935 (Langford, 1938). In the absence of a coldwater fishery, the oxygen depletion of this small area should not be of concern.

Generally, the chemical water quality of the lake typifies a mesotrophic lake with acceptable levels of all of the parameters measured. The water chemistry has minimized or eliminated any effects of acidification, and zebra mussel invasion is unlikely. The levels of nutrients are high enough to sustain a productive warmwater fishery, while nuisance levels of algae are mostly absent in the main body of the lake. Eutrophic conditions prevail in sheltered embayments receiving inflows from watersheds with significant agricultural activity.

References

Dillon, P.J. and F.H. Rigler. 1975. A Simple Method for Predicting the Capacity of a Lake for Development Based on Lake Trophic Status. J. Fish. Res. Board Can. 32: 1519-1531.

Jorgensen, C. 1990. Lake Nipissing fisheries data review and summary of problems, issues, and proposed management tactics. Ministry of Natural Resources report. 44p.

Langford, R.R. 1938. The Limnetic Crustacea of Lake Nipissing. 125p.

Ontario Ministry of the Environment. 1981. Outlines of Analytical Methods. 246 p.

Ontario Ministry of the Environment. 1990. Guide to Eating Ontario Sport Fish. Ministry of the Environment and Ministry of Natural Resources. p39.

Pitblado, J.R., W. Keller, and N.I. Conroy. 1980. A classification and description of some northeastern Ontario lakes influenced by acid precipitation. J. Great Lakes Res., 6: 247.

Ramcharan, C.W., D.K. Padilla, and S.I. Dodson. 1991. Predicted population dynamics of *Dreissena polymorpha* in the Great Lakes based on analysis of European data. Presented at the American Society of Limnology and Oceanography Conference, June 11. Halifax, Nova Scotia.

Sprung, M. 1987. Ecological Requirements of developing Dreissena polymorpha eggs. Arch. Hydrobiol/Suppl. 79: 69-86.

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Appendix A: Three Year Summaries of Water Chemistry by Station

Water Chemistry Parameter Abbreviations

PH	pH
ALK	Inflection Point Alkalinity ($mg.L^{-1}$ as $CaCO_3$)
COND	Conductivity (μSiemens)
CA	Calcium ($mg.L^{-1}$)
MG	Magnesium ($mg.L^{-1}$)
NA	Sodium ($mg.L^{-1}$)
K	Potassium ($mg.L^{-1}$)
CLI	Chloride ($mg.L^{-1}$)
SO4	Sulphate ($mg.L^{-1}$)
DOC	Dissolved Organic Carbon ($mg.L^{-1}$ as C)
FE	Iron ($mg.L^{-1}$)
MN	Manganese ($mg.L^{-1}$)
NNO	Nitrate ($\mu g.L^{-1}$ as N)
NNH	Ammonia+Ammonium ($\mu g.L^{-1}$ as N)
NNT	Total Kjeldahl Nitrogen ($\mu g.L^{-1}$ as N)
P	Total Phosphorus ($\mu g.L^{-1}$)

STN		PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG1	min	7.20	15.40	77.00	6.50	2.10	3.00	0.65	3.52	9.20	4.4	0.000	0.005	0	2	250	8.5
IG1	max	7.63	21.79	89.10	8.60	2.84	5.10	0.85	7.00	11.50	5.6	0.260	0.017	80	90	450	16.0
IG1	avg	7.42	19.54	82.56	7.63	2.39	3.76	0.76	4.43	10.57	5.1	0.102	0.010	26	29	333	12.5
IG2	min	6.98	11.20	57.00	5.50	1.70	2.30	0.59	2.50	8.90	4.3	0.043	0.005	0	3	30	8.4
IG2	max	7.66	22.08	89.50	9.10	2.96	4.28	0.80	4.90	11.40	7.5	0.560	0.040	60	38	490	24.0
IG2	avg	7.39	19.29	80.38	7.73	2.43	3.31	0.72	3.61	10.57	5.5	0.171	0.015	23	20	317	14.1
IG3	min	7.10	12.60	65.00	5.85	1.80	2.60	0.60	2.50	9.20	4.6	0.066	0.006	0	1	280	4.9
IG3	max	8.02	23.34	87.40	8.80	3.00	3.70	0.80	4.30	11.30	8.3	0.290	0.023	40	38	480	22.0
IG3	avg	7.44	19.48	80.09	7.88	2.48	3.10	0.69	3.31	10.57	5.8	0.177	0.013	17	18	328	12.6
IG4	min	7.09	11.80	56.00	6.50	1.75	1.40	0.55	1.40	9.70	4.5	0.035	0.006	0	3	280	8.5
IG4	max	7.56	23.00	92.00	9.00	2.75	3.60	0.80	3.80	12.40	6.7	0.380	0.036	44	44	450	24.5
IG4	avg	7.34	18.58	76.69	7.55	2.33	2.91	0.68	2.89	10.79	5.7	0.182	0.016	17	17	324	14.4
IG5	min	7.10	11.10	54.00	5.83	1.70	1.50	0.48	1.20	9.10	5.2	0.085	0.008	0	0	280	9.5
IG5	max	7.41	21.41	83.20	8.10	2.45	3.50	0.75	3.48	13.10	9.0	0.420	0.037	220	34	410	18.5
IG5	avg	7.19	16.86	72.76	7.28	2.22	2.67	0.64	2.39	10.69	6.4	0.189	0.018	37	15	337	14.1
IG6	min	6.84	10.40	53.00	5.20	1.50	1.55	0.45	1.00	9.60	4.5	0.100	0.011	0	0	250	8.0
IG6	max	7.38	23.00	91.00	8.50	2.45	4.80	1.50	2.80	13.30	12.5	0.330	0.054	240	38	400	22.5
IG6	avg	7.10	16.01	70.06	7.23	2.11	2.49	0.64	1.62	11.10	7.4	0.193	0.030	40	13	326	14.2
IG7	min	7.40	41.00	120.00	1.70	2.35	2.90	0.02	3.80	6.00	5.5	0.044	0.007	0	8	85	16.8
IG7	max	10.28	66.00	173.00	22.00	6.60	3.90	1.35	5.70	12.70	10.7	0.440	0.038	130	106	810	48.5
IG7	avg	8.57	49.01	134.63	15.14	4.66	3.35	0.69	4.51	8.58	8.4	0.175	0.015	19	38	595	30.0
IG8	min	7.19	17.20	77.00	7.00	2.25	3.10	0.70	3.40	8.80	4.1	0.036	0.003	0	2	240	8.0
IG8	max	7.52	22.00	86.00	8.30	2.70	4.80	0.85	7.20	11.40	5.4	0.120	0.053	70	48	360	24.0
IG8	avg	7.41	19.02	80.62	7.60	2.40	3.47	0.75	4.11	10.56	4.8	0.070	0.017	23	23	313	12.4

STN		PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG9	min	7.11	15.60	78.00	6.50	2.15	3.80	0.55	4.80	8.20	5.2	0.049	0.010	0	1	390	13.0
IG9	max	8.80	20.00	87.00	9.10	2.82	4.40	1.20	6.60	10.55	6.7	0.256	0.080	120	220	650	36.5
IG9	avg	7.43	18.43	82.23	7.45	2.37	4.03	0.93	5.41	9.41	6.0	0.140	0.027	32	50	504	22.4
IG10	min	7.18	17.40	72.00	6.00	1.95	3.04	0.66	3.24	9.20	4.3	0.039	0.004	0	1	260	7.5
IG10	max	7.58	21.64	89.00	8.30	2.70	3.90	0.80	4.80	11.50	5.8	0.220	0.021	90	40	370	16.2
IG10	avg	7.42	19.36	80.89	7.59	2.40	3.48	0.74	3.91	10.57	5.1	0.075	0.011	22	20	316	12.4
IG11	min	7.20	14.80	77.00	6.00	2.05	3.04	0.67	3.28	8.90	4.5	0.041	0.005	0	3	260	1.8
IG11	max	7.60	23.00	98.00	8.80	2.84	5.70	0.90	7.90	11.50	5.8	0.240	0.013	135	166	680	27.0
IG11	avg	7.43	19.66	85.84	7.65	2.43	4.09	0.79	4.94	10.64	5.2	0.100	0.010	45	52	406	14.2
IG12	min	7.06	12.90	60.00	0.80	1.80	2.05	0.58	2.10	9.40	4.3	0.025	0.003	0	3	250	8.0
IG12	max	7.56	20.93	87.00	8.10	2.58	3.39	0.75	5.10	11.40	5.3	0.140	0.026	60	40	360	16.5
IG12	avg	7.36	18.34	77.57	6.98	2.35	3.05	0.70	3.53	10.66	5.0	0.071	0.013	22	18	312	12.3
IG13	min	7.11	14.70	68.00	6.25	2.00	2.60	0.60	2.70	9.20	4.3	0.028	0.002	0	4	280	5.5
IG13	max	7.60	20.97	90.00	8.10	2.61	3.44	0.75	4.10	12.60	6.2	0.250	0.029	60	44	370	17.0
IG13	avg	7.38	18.50	78.46	7.47	2.35	3.16	0.71	3.51	10.73	5.1	0.080	0.014	21	19	320	12.5
IG14	min	6.99	10.70	60.00	5.05	1.55	2.98	0.60	3.20	8.90	4.2	0.035	0.004	0	3	240	6.9
IG14	max	7.67	20.00	84.40	8.10	2.53	3.60	0.80	4.30	11.60	5.6	0.260	0.034	100	36	370	17.5
IG14	avg	7.40	17.64	76.79	7.16	2.27	3.26	0.73	3.68	10.39	5.0	0.088	0.015	21	16	314	12.2
IG15	min	7.13	16.90	75.00	5.15	2.24	3.10	0.65	3.16	10.10	4.2	0.028	0.003	0	2	240	7.5
IG15	max	7.65	20.80	89.00	8.10	2.62	3.60	0.76	4.00	12.80	5.6	0.110	0.063	70	38	400	17.0
IG15	avg	7.42	18.62	79.38	7.41	2.37	3.33	0.72	3.62	10.76	5.0	0.061	0.016	24	18	319	12.3
IG16	min	7.30	17.60	71.00	0.84	2.35	1.95	0.24	1.69	6.00	4.7	0.051	0.008	0	3	370	13.5
IG16	max	8.69	39.43	121.00	12.90	4.46	2.83	1.57	3.50	10.80	8.9	0.480	0.021	29	300	600	50.5
IG16	avg	7.61	23.35	81.14	7.96	2.88	2.38	0.78	2.51	9.32	6.2	0.160	0.014	8	49	453	24.0
IG17	min	7.13	15.80	60.00	5.85	2.00	1.90	0.34	2.02	7.10	4.5	0.083	0.009	0	2	310	9.5
IG17	max	8.11	26.00	83.00	8.70	2.85	2.95	0.90	3.30	11.40	6.9	0.280	0.020	20	58	410	23.5
IG17	avg	7.47	19.20	73.03	7.32	2.43	2.45	0.70	2.49	9.82	5.7	0.168	0.014	7	26	373	17.4

STN		PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG18	min	7.07	15.70	61.00	5.85	2.20	1.75	0.48	1.80	8.00	5.0	0.034	0.006	0	6	340	10.0
IG18	max	7.58	20.16	76.00	7.65	2.76	2.69	0.80	2.84	10.45	6.8	0.270	0.021	20	54	460	23.5
IG18	avg	7.35	18.17	69.59	6.88	2.47	2.20	0.67	2.30	9.06	5.9	0.118	0.013	7	24	386	16.0
IG19	min	7.17	15.80	62.00	5.85	2.30	1.75	0.53	1.90	7.60	5.3	0.060	0.008	0	6	350	13.0
IG19	max	7.55	20.00	77.00	7.50	2.84	2.43	0.80	4.20	9.70	7.0	0.430	0.018	20	56	500	28.0
IG19	avg	7.40	18.39	69.21	6.89	2.55	2.02	0.72	2.29	8.57	6.2	0.131	0.012	6	24	420	18.7
IG20	min	7.00	9.30	49.00	5.00	1.50	1.50	0.55	1.10	9.10	4.6	0.039	0.004	0	3	310	10.5
IG20	max	7.92	21.23	88.00	8.10	2.65	3.22	0.74	3.50	12.00	48.0	0.810	0.022	80	42	390	33.5
IG20	avg	7.42	17.57	72.69	7.16	2.30	2.60	0.68	2.59	10.39	8.4	0.243	0.012	12	19	339	16.7
IG21	min	7.10	11.40	57.00	5.85	1.70	1.85	0.50	1.50	9.70	4.6	0.053	0.008	0	1	280	10.0
IG21	max	7.58	21.00	86.00	8.30	2.70	3.34	7.00	4.09	12.20	7.5	0.520	0.030	90	36	370	32.0
IG21	avg	7.39	18.30	75.91	7.28	2.30	2.84	1.08	2.96	10.59	5.5	0.190	0.017	20	19	311	15.0
IG22	min	7.27	17.50	72.00	7.00	2.25	2.50	0.64	2.60	10.00	4.4	0.060	0.007	0	2	240	8.0
IG22	max	7.60	21.16	91.00	8.50	2.66	4.30	0.76	5.40	11.50	6.7	0.240	0.050	60	40	360	15.0
IG22	avg	7.41	19.22	79.87	7.67	2.45	3.19	0.70	3.40	10.74	5.1	0.101	0.016	21	19	304	12.6
IG23	min	7.17	17.40	73.00	6.50	2.25	0.30	0.65	3.10	8.00	4.5	0.045	0.005	0	2	240	8.5
IG23	max	7.63	21.00	88.00	8.10	2.72	3.80	0.80	4.40	11.40	6.2	0.120	0.052	63	46	360	17.5
IG23	avg	7.43	19.26	80.06	7.54	2.45	3.06	0.72	3.56	10.57	5.1	0.073	0.014	21	22	296	12.2
IG24	min	7.18	17.10	73.00	7.00	2.30	2.70	0.65	2.80	10.40	4.3	0.047	0.006	0	1	240	9.5
IG24	max	7.66	21.00	89.00	8.20	2.70	3.40	0.75	3.80	11.40	5.8	0.120	0.067	60	38	340	16.0
IG24	avg	7.41	19.20	79.61	7.60	2.44	3.14	0.71	3.32	10.81	5.0	0.083	0.015	21	18	294	11.5
IG25	min	6.92	16.16	70.60	6.50	0.65	2.52	0.65	2.40	10.10	4.6	0.030	0.010	0	7	270	6.0
IG25	max	7.51	20.45	83.00	8.05	2.55	3.35	0.78	3.70	12.20	5.3	0.100	0.065	110	44	355	16.5
IG25	avg	7.30	18.03	77.25	7.43	2.25	3.04	0.71	3.19	10.71	5.1	0.054	0.020	26	21	301	11.3
IG26	min	6.99	16.00	67.00	6.50	0.60	2.30	0.65	2.10	9.80	4.7	0.000	0.004	0	4	250	6.5
IG26	max	7.53	19.31	83.00	7.65	2.48	3.30	0.75	3.50	11.80	6.0	0.140	0.056	80	38	390	17.0
IG26	avg	7.31	17.76	74.49	7.15	2.20	2.88	0.70	3.03	10.39	5.3	0.052	0.019	17	24	308	11.4

Appendix B: Measured Water Chemistry

Measurements taken under the ice are highlighted

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG1	880518	7.29	20.96	89.1	8.50	2.84	4.72	0.83	5.60	10.80	4.5	0.063		64	34	330	12.1
IG1	880720	7.57	20.19	82.7	8.05	2.46	3.58	0.78	4.05	11.10	4.7	0.074		0	7	300	12.0
IG1	880819	7.63	21.79	84.1	7.65	2.45	3.35	0.73	3.52	10.55	4.4	0.083		5	8	280	10.7
IG1	881006	7.36	21.43	85.0	7.82	2.46	3.42	0.82	3.80	11.50	5.1	0.091	0.008	0	2	260	10.7
IG1	881101	7.48	21.19	85.0	7.97	2.61	3.21	0.71	3.60	11.20	4.9	0.170		0	4	250	15.3
IG1	890517	7.45	17.80	86.0	7.23	2.20	5.10	0.75	6.90	10.30	5.1	0.088	0.012	80	62	385	12.5
IG1	890614	7.40	18.90	79.0	7.95	2.25	3.40	0.65	3.80	10.60	5.3	0.130	0.010	40	36	320	14.5
IG1	890719	7.44	18.40	80.0	7.00	2.25	3.55	0.70	4.40	10.40	5.1	0.000	0.007	60	36	320	11.0
IG1	890817	7.52	19.70	80.0	7.00	2.10	3.40	0.75	4.00	10.70	5.2	0.042	0.009	0	26	340	10.5
IG1	890914	7.49	19.70	80.0	7.70	2.40	3.55	0.75	3.60	10.80	5.0	0.073	0.009	0	16	380	15.5
IG1	900320	7.18	23.00	98.0	9.00	2.80	4.40	0.85	5.40	12.00	5.7	0.065	0.007	70	48	360	17.0
IG1	900504	7.21	15.40	81.0	6.50	2.10	4.90	0.80	7.00	9.20	4.6	0.260	0.017	80	90	420	16.0
IG1	900615	7.20	17.20	77.0	7.00	2.20	3.90	0.80	4.50	9.80	5.4	0.120	0.011	25	40	450	13.5
IG1	900726	7.51	19.40	83.0	7.50	2.35	3.90	0.70	4.40	10.40	5.2			5	24	310	8.5
IG1	900821	7.39	19.90	83.0	7.50	2.40	3.30	0.70	4.10	10.80	5.5	0.085	0.005	5	36	310	11.5
IG1	900917	7.26	19.60	83.0	8.10	2.50	3.00	0.80	3.80	10.50	5.6	0.120	0.011	20	22	400	14.5
IG1	901031	7.44	21.00	83.0	8.60	2.60	3.85	0.85	3.80	10.50	5.4	0.130	0.007	30	24	280	11.0
IG2	880518	7.38	21.96	89.5	8.70	2.96	4.28	0.80	4.90	11.10	4.3	0.044		44	26	320	12.2
IG2	880713	7.47		80.5	8.15	2.49	3.35	0.77	3.60	10.65	4.7	0.043		3	11	270	8.4
IG2	880819	7.66	22.08	84.7	7.75	2.51	3.35	0.74	3.32	10.80	4.4	0.150		6	9	290	16.8
IG2	881101	7.24	16.41	78.0	6.97	2.22	2.47	0.59	2.50	11.00	7.5	0.380		22	3	320	22.0
IG2	890517	7.41	19.60	87.0	7.95	2.50	4.00	0.75	4.70	11.40	5.2	0.062	0.040	40	6	310	10.0
IG2	890614	7.41	18.30	77.0	7.95	2.40	3.40	0.65	3.40	10.40	5.2	0.200	0.012	40	28	300	15.5
IG2	890719	7.41	19.50	80.0	7.30	2.35	3.25	0.70	3.90	10.60	5.0	0.060	0.005	60	32	300	11.5
IG2	890817	7.40	19.70	81.0	7.10	2.15	3.45	0.75	4.10	10.90	5.2	0.049	0.008	0	24	350	11.0
IG2	890914	7.49	19.70	80.0	7.70	2.45	3.55	0.75	3.60	10.80	5.2	0.079	0.009	0	24	400	16.5
IG2	900320	7.30	24.00	95.0	9.50	2.85	4.00	0.90	4.40	12.20	5.5	0.040	0.005	40	16	320	9.0
IG2	900504	6.98	11.20	57.0	5.50	1.70	2.30	0.60	2.60	8.90	7.2	0.310	0.030	40	26	360	13.0
IG2	900615	7.18	17.60	78.0	7.50	2.30	3.50	0.75	4.00	10.00	5.9	0.210	0.010	35	38	490	15.0
IG2	900726	7.51	21.00	81.0	8.00	2.55	3.00	0.65	3.00	10.30	5.7			5	10	330	11.0
IG2	900821	7.44	21.00	84.0	8.00	2.50	3.20	0.70	3.50	10.60	5.4	0.160	0.008	15	36	300	12.5
IG2	900917	7.31	20.00	85.0	8.30	2.60	3.10	0.75	3.80	10.50	5.3	0.080	0.007	10	16	380	12.5
IG2	901031	7.52	22.00	83.0	9.10	2.75	3.45	0.80	3.30	10.60	6.8	0.560	0.020	20	10	30	24.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG3	880518	7.44	22.59	87.4	8.80	3.00	3.70	0.75	3.90	11.00	4.6	0.084		17	16	320	10.7
IG3	880713	7.52		84.6	8.70	2.67	3.23	0.76	3.40	10.70	4.9	0.160		4	7	280	4.9
IG3	880819	8.02	23.34	86.3	8.10	2.53	3.32	0.69	3.12	10.60	4.9	0.190		2	7	310	16.5
IG3	881103	7.41	20.05	86.0	7.82	2.51	2.95	0.61	3.20	11.30	7.3	0.290		15	1	350	22.0
IG3	890517	7.18	12.60	65.0	5.85	1.80	3.35	0.65	4.30	9.20	7.4	0.210	0.023	10	14	355	11.0
IG3	890614	7.51	18.60	77.0	8.05	2.50	2.80	0.65	3.10	11.20	5.5	0.260	0.011	30	28	310	13.5
IG3	890719	7.46	20.00	84.0	7.60	2.50	3.35	0.70	4.20	10.60	4.9	0.066	0.006	40	34	310	13.0
IG3	890817	7.39	18.80	82.0	7.50	2.30	3.10	0.70	3.40	10.70	5.3	0.087	0.015	0	22	330	12.0
IG3	890914	7.61	22.20	83.0	8.20	2.65	3.30	0.75	3.20	10.90	4.9	0.100	0.006	10	20	310	12.5
IG3	900320	6.69	13.40	93.0	7.00	2.10	6.20	0.85	9.90	10.30	9.1	0.640	0.056	370	174	560	17.0
IG3	900504	7.10	13.30	66.0	6.50	2.00	2.70	0.60	3.30	10.00	6.1	0.190	0.023	40	26	350	11.5
IG3	900615	7.24	17.30	72.0	7.50	2.30	2.60	0.70	2.50	9.80	6.4	0.230	0.009	40	38	480	17.0
IG3	900726	7.45	20.00	79.0	8.00	2.47	2.95	0.65	2.80	10.50	5.6			5	18	300	8.5
IG3	900821	7.48	21.00	83.0	8.00	2.55	3.00	0.65	3.00	10.80	5.5	0.220	0.011	10	18	290	12.5
IG3	900917	7.46	22.00	85.0	8.80	2.70	2.70	0.70	3.10	10.50	5.5	0.140	0.008	10	12	300	7.5
IG3	901031	7.32	21.00	81.0	8.80	2.75	3.40	0.80	3.20	10.80	8.3	0.250	0.017	20	10	330	16.0
IG4	880518	7.21	16.65	71.5	7.30	2.48	2.64	0.64	2.50	10.70	5.7	0.120		44	15	310	13.2
IG4	880713	7.39		82.5	8.30	2.54	3.29	0.76	3.40	10.65	4.8	0.120		2	8	280	13.2
IG4	880816	7.56	20.05	81.8	7.40	2.30	3.32	0.76	3.19	10.15	4.5	0.100		9	10	280	15.2
IG4	881006	7.34	21.61	85.0	7.89	2.48	3.26	0.66	3.60	11.50	5.5	0.290	0.019	0	4	280	19.0
IG4	881101	7.36	19.39	82.0	7.68	2.51	2.70	0.67	2.90	11.30	6.7	0.280		15	3	340	24.5
IG4	890517	7.38	15.20	71.0	6.50	2.05	3.30	0.63	3.80	9.70	5.8	0.110	0.011	30	10	340	8.5
IG4	890614	7.40	16.70	73.0	7.27	2.27	2.65	0.65	2.90	10.30	5.4	0.250	0.017	35	30	320	18.0
IG4	890719	7.20	18.00	73.0	7.00	2.15	2.65	0.60	2.20	11.00	6.0	0.260	0.022	30	22	340	19.0
IG4	890817	7.54	22.00	78.0	6.90	2.05	3.05	0.75	3.30	10.70	5.0	0.130	0.013	0	20	320	11.5
IG4	890914	7.37	19.50	79.0	7.80	2.45	3.30	0.70	2.50	12.00	5.4	0.107	0.009	20	14	300	13.5
IG4	900321	7.22	23.00	92.0	9.00	2.75	3.60	0.80	3.50	12.40	5.9	0.035	0.006	0	10	340	10.0
IG4	900504	7.09	11.80	56.0	6.50	1.75	1.40	0.55	1.40	9.80	6.0	0.380	0.036	40	32	330	14.0
IG4	900615	7.15	17.10	71.0	7.50	2.25	2.60	0.70	2.40	10.40	6.2	0.260	0.022	30	44	450	13.5
IG4	900725	7.41	18.40	73.0	7.50	2.25	2.80	0.60	2.60	10.40	5.8			5	30	330	11.0
IG4	900821	7.38	18.90	77.0	7.50	2.35	2.90	0.60	2.70	11.00	5.8	0.190	0.015	5	22	320	15.0
IG4	900917	7.35	19.00	80.0	8.00	2.50	2.80	0.75	3.40	10.50	5.3	0.084	0.008	10	6	320	10.5
IG4	901031	7.36	20.00	78.0	8.30	2.55	3.20	0.80	2.80	11.00	6.4	0.190	0.009	20	14	300	15.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG5	880518	7.12	14.54	65.7	7.00	2.36	2.12	0.61	2.20	10.70	5.4	0.110		61	18	310	13.9
IG5	880713	7.28		80.2	8.10	2.44	3.15	0.72	3.48	10.55	5.2	0.085		0	5	280	11.4
IG5	880816	7.13	21.41	83.2	7.80	2.31	3.45	0.65	1.40	11.50	6.4	0.150		5	3	330	18.5
IG5	881101	6.99	11.30	60.0	5.83	1.74	1.71	0.48	1.60	10.20	9.0	0.320		55	0	330	15.6
IG5	890517	7.30	14.00	65.0	5.85	1.90	2.75	0.60	3.40	9.10	6.1	0.150	0.017	30	12	335	9.5
IG5	890614	7.37	16.40	71.0	7.25	2.20	2.55	0.65	2.40	10.30	5.5	0.240	0.015	30	24	320	15.0
IG5	890719	7.19	18.00	73.0	7.40	2.25	2.65	0.65	2.30	10.60	5.9	0.300	0.023	30	22	350	18.0
IG5	890817	7.24	20.00	79.0	7.80	2.35	3.10	0.65	2.80	11.00	5.6	0.160	0.018	0	12	340	13.5
IG5	890914	7.31	19.70	79.0	7.90	2.40	3.35	0.65	2.60	10.90	5.8	0.150	0.013	0	18	320	14.0
IG5	900321	6.79	18.40	85.0	8.00	2.35	3.50	0.75	2.60	13.10	8.1	0.130	0.027	220	28	360	13.0
IG5	900504	7.00	11.10	54.0	6.00	1.70	1.50	0.55	1.20	9.90	6.6	0.420	0.037	50	8	330	13.5
IG5	900615	7.13	16.60	70.0	7.50	2.25	2.40	0.70	2.20	10.20	6.5	0.260	0.021	30	34	410	14.0
IG5	900725	7.41	18.70	74.0	7.50	2.30	2.60	0.60	2.20	10.50	6.5			5	28	390	16.5
IG5	900821	7.35	18.60	77.0	7.00	2.30	2.60	0.60	2.60	11.10	6.0	0.094	0.008	5	14	300	11.0
IG5	900917	7.37	18.80	80.0	8.00	2.45	2.80	0.75	3.40	10.50	5.3	0.087	0.011	10	8	360	14.0
IG5	901031	7.10	15.40	68.0	7.50	2.20	2.45	0.60	1.80	10.90	8.8	0.180	0.011	60	10	330	14.0
IG6	880518	7.01	14.43	64.4	6.80	2.36	2.08	0.61	1.80	10.70	5.4	0.110		59	15	310	13.3
IG6	880713	7.18		80.4	8.15	2.45	3.17	0.71	2.80	10.75	5.2	0.330		0	8	310	20.0
IG6	880816	7.25	21.59	82.2	7.95	2.43	2.97	0.58	1.69	10.65	5.6	0.100		3	1	330	16.3
IG6	881103	6.86	10.62	60.0	5.69	1.70	1.85	0.47	1.50	10.50	9.8	0.230		55	5	350	11.6
IG6	890517	7.04	10.40	53.0	5.20	1.50	1.70	0.45	1.10	9.60	6.8	0.220	0.031	50	0	295	10.0
IG6	890614	7.34	15.00	67.0	7.05	2.10	2.20	0.55	2.00	10.40	5.9	0.230	0.019	20	18	300	14.0
IG6	890719	7.08	18.30	73.0	7.70	2.10	2.80	0.50	1.00	11.60	8.8	0.190	0.054	10	18	320	13.5
IG6	890817	6.98	19.90	81.0	8.10	2.20	3.75	0.55	1.20	12.80	12.2	0.190	0.042	0	6	310	13.5
IG6	890914	7.20	18.20	71.0	7.90	2.30	1.70	0.50	1.00	12.00	4.5	0.114	0.016	20	12	250	10.0
IG6	900321	6.84	13.30	67.0	7.00	2.00	2.10	0.80	1.60	11.90	8.6	0.330	0.052	240	26	390	16.5
IG6	900504	7.11	13.60	61.0	6.50	1.95	1.80	0.60	1.50	10.00	6.8			40	4	390	18.0
IG6	900615	7.08	16.10	69.0	7.50	2.10	2.60	0.60	1.80	10.80	7.5	0.220	0.031	20	24	360	11.5
IG6	900725	7.18	15.80	67.0	7.50	2.10	1.80	0.45	1.00	11.50	5.7			40	38	310	16.5
IG6	900821	7.38	18.40	76.0	7.50	2.25	2.90	0.65	2.70	10.80	5.8	0.100	0.011	5	18	300	12.0
IG6	900917	6.87	23.00	91.0	8.50	2.40	4.80	0.70	1.70	13.30	12.5	0.190	0.036	10	2	400	22.5
IG6	901031	7.12	11.50	58.0	6.70	1.85	1.55	1.50	1.50	10.30	7.6	0.150	0.012	60	12	290	8.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG7	880518	7.42	43.91	126.1	15.60	4.60	3.48	0.90	5.10	9.85	6.4	0.190		4	29	580	43.0
IG7	880720	10.28	49.68	148.0	18.00	4.80	3.02	0.04	3.98	8.70	8.9	0.058		0	8	600	16.8
IG7	880816	9.06	50.94	131.0	12.60	4.54	3.37	0.31	4.50	7.80	8.4	0.340		4	10	810	48.5
IG7	881101	7.66	55.93	154.0	18.60	5.28	3.21	1.28	5.00	10.20	10.7	0.440		112	28	620	33.0
IG7	890517	7.67	43.00	124.0	14.15	4.00	3.55	1.10	5.70	7.20	5.7	0.190	0.017	0	18	560	35.5
IG7	890614	7.86	45.50	127.0	15.65	2.35	3.40	0.60	4.30	7.70	7.0	0.096	0.007	0	36	590	29.0
IG7	890719	9.17	49.00	125.0	1.70	4.55	3.55	0.25	4.70	6.90	8.0	0.098	0.010	10	40	600	28.5
IG7	890817	9.56	46.00	123.0	14.60	4.40	3.35	0.25	4.40	6.50	8.1	0.120	0.015	0	24	610	24.0
IG7	890914	9.38	47.40	122.0	14.00	4.65	3.40	0.50	5.00	6.00	8.3	0.084	0.011	0	48	640	21.0
IG7	900321	7.47	66.00	200.0	24.50	7.20	4.60	1.65	8.50	13.50	7.3	0.360	0.027	1750	92	730	57.0
IG7	900504	7.58	41.00	120.0	14.50	3.90	3.10	0.95	4.00	9.70	5.5			0	42	520	31.0
IG7	900615	7.40	44.80	126.0	16.00	4.35	3.40	1.20	4.40	9.40	9.5	0.350	0.038	20	106	720	37.5
IG7	900725	8.28	50.00	134.0	16.50	4.95	3.50	1.00	4.40	8.60	9.8			10	42	660	25.5
IG7	900822	8.39	54.00	146.0	17.00	6.00	3.40	0.65	4.10	8.90	10.0	0.120	0.018	5	62	650	27.5
IG7	900917	9.34	48.00	132.0	15.80	5.00	2.90	0.65	4.10	8.10	10.2	0.076	0.008	10	30	680	20.5
IG7	901031	7.85	66.00	173.0	22.00	6.60	3.90	1.35	4.70	12.70	10.1	0.250	0.007	130	66	85	36.0
IG8	880518	7.19	18.65	78.9	7.80	2.70	3.38	0.76	3.60	10.50	4.3	0.043		55	20	300	10.4
IG8	880713	7.52		82.3	8.05	2.38	3.36	0.77	3.60	10.60	4.7	0.040		0	9	300	9.6
IG8	880819	7.41	20.73	83.7	7.50	2.41	3.44	0.76	3.51	10.60	4.3	0.090		8	17	330	24.0
IG8	881006	7.51	20.94	84.0	7.59	2.46	3.42	0.79	3.90	11.40	4.6	0.073	0.013	0	2	240	12.6
IG8	881103	7.46	20.92	86.0	7.97	2.60	3.21	0.71	3.70	11.20	5.0	0.120		0	3	260	12.3
IG8	890516	7.31	17.20	77.0	7.20	2.25	3.25	0.85	3.90	10.50	4.7	0.099	0.053	70	18	315	11.5
IG8	890614	7.33	17.30	77.0	7.40	2.30	3.40	0.70	4.20	10.40	5.0	0.084	0.012	50	30	300	10.5
IG8	890719	7.38	18.00	78.0	7.30	2.30	3.25	0.70	3.70	8.80	5.0	0.045	0.008	40	34	300	9.5
IG8	890817	7.50	19.00	79.0	7.60	2.30	3.20	0.70	3.60	10.60	5.1	0.055	0.027	0	30	320	11.0
IG8	890914	7.48	19.10	79.0	7.60	2.40	3.35	0.75	3.50	11.20	5.1	0.083	0.025	0	12	320	16.0
IG8	900320	5.95	3.10	14.0	1.00	0.25	0.50	0.15	0.60	1.70	0.6	0.000	0.004	350	188	270	7.5
IG8	900504	7.37	17.60	85.0	7.00	2.30	4.80	0.75	6.30	10.50	4.1			60	48	350	12.0
IG8	900615	7.20	17.50	77.0	7.50	2.30	3.70	0.75	4.20	10.60	5.1	0.087	0.009	30	36	350	12.0
IG8	900725	7.51	18.40	80.0	7.50	2.40	3.70	0.75	7.20	10.70	5.0			20	38	310	8.0
IG8	900821	7.40	18.20	79.0	7.50	2.25	3.20	0.70	3.80	10.50	5.4	0.058	0.012	5	38	320	14.0
IG8	900918	7.44	19.70	82.0	7.80	2.50	3.10	0.75	3.70	10.50	5.2	0.070	0.013	10	12	360	13.0
IG8	901102	7.50	22.00	82.0	8.30	2.60	3.70	0.80	3.40	10.40	4.7	0.036	0.003	20	24	330	12.5

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG9	880518	7.17	18.10	83.7	7.60	2.82	4.00	1.10	5.40	10.10	5.4	0.087		96	35	420	20.5
IG9	880720	8.80	19.67	86.6	8.55	2.40	3.98	0.92	4.87	10.55	5.8	0.049		0	1	530	17.6
IG9	880816	7.42	19.89	84.4	7.40	2.41	3.85	0.89	4.80	10.30	5.2	0.110		8	6	510	23.5
IG9	881006	7.35	19.93	86.0	7.30	2.33	3.90	0.84	5.40	10.20	6.5	0.160	0.026	13	15	400	19.5
IG9	881101	7.33	19.80	87.0	7.68	2.54	3.80	0.93	5.20	10.00	6.7	0.170		13	18	390	22.5
IG9	890516	7.27	16.30	78.0	6.50	2.15	4.35	1.20	6.60	8.20	5.8	0.220	0.022	120	46	485	20.5
IG9	890614	7.31	16.60	78.0	9.10	2.25	3.85	0.55	5.40	8.40	6.0	0.160	0.021	60	34	400	17.5
IG9	890719	7.43	18.20	80.0	7.20	2.30	4.05	0.90	5.40	8.70	6.4	0.094	0.013	20	44	470	20.0
IG9	890817	7.59	19.00	81.0	7.40	2.25	3.85	0.85	5.30	9.40	6.2	0.110	0.030	0	28	650	21.5
IG9	890914	7.29	20.00	83.0	7.50	2.45	3.85	0.90	5.20	8.90	5.9	0.256	0.080	0	220	650	36.5
IG9	900320	6.90	14.50	69.0	6.00	2.20	2.90	1.65	3.60	8.40	6.9	0.960	0.073	400	100	600	56.5
IG9	900504	7.27	15.60	80.0	6.50	2.30	4.20	1.05	6.50	9.30	5.4			90	64	520	19.5
IG9	900615	7.20	16.50	79.0	7.00	2.25	4.40	1.00	5.20	9.40	6.1	0.120	0.015	20	54	390	13.0
IG9	900726	7.66	19.90	81.0	7.50	2.35	4.10	0.90	5.60	9.40	6.1			10	24	590	18.5
IG9	900821	7.11	18.00	82.0	7.00	2.25	4.00	0.90	5.50	9.10	6.1	0.150	0.032	10	108	540	34.0
IG9	900918	7.24	18.40	84.0	7.30	2.40	3.90	0.90	5.10	9.20	6.0	0.150	0.023	10	66	640	30.5
IG9	901102	7.37	19.00	82.0	7.60	2.40	4.40	1.05	5.10	9.40	6.7	0.130	0.010	40	38	480	24.0
IG10	880518	7.18	18.83	81.0	7.80	2.70	3.66	0.78	4.10	10.50	4.3	0.047		58	19	320	12.2
IG10	880720	7.51	19.56	82.9	7.90	2.41	3.42	0.76	3.74	10.90	4.8	0.040		0	1	280	9.6
IG10	880819	7.54	21.31	84.4	7.70	2.47	3.35	0.74	3.24	10.40	4.4	0.077		3	5	290	16.0
IG10	881006	7.48	21.64	89.0	7.72	2.50	3.90	0.73	4.70	11.50	5.1	0.093	0.008	13	15	300	11.9
IG10	881101	7.48	21.51	86.0	8.10	2.64	3.04	0.66	3.40	11.20	5.8	0.220		0	2	260	16.2
IG10	890516	7.40	19.60	83.0	7.85	2.40	3.75	0.70	4.40	11.10	4.5	0.059	0.021	25	12	320	7.5
IG10	890614	7.43	17.60	79.0	7.25	2.30	3.65	0.75	4.80	10.10	5.1	0.099	0.011	50	28	340	14.0
IG10	890719	7.46	18.20	77.0	7.30	2.30	3.30	0.70	3.80	10.40	5.1	0.043	0.008	40	36	300	11.0
IG10	890817	7.43	18.90	79.0	7.50	2.25	3.25	0.70	3.70	10.70	5.3	0.047	0.014	0	22	340	12.0
IG10	890914	7.58	18.50	78.0	7.75	2.40	3.35	0.75	3.50	10.90	5.0	0.039	0.011	0	14	350	14.5
IG10	900320	7.45	24.00	92.0	9.00	2.80	3.80	0.80	3.80	11.80	5.0	0.000	0.002	0	18	290	22.0
IG10	900504	7.38	21.00	72.0	6.00	1.95	3.30	0.80	3.30	9.20	5.1			90	38	330	12.5
IG10	900615	7.30	17.40	77.0	7.50	2.25	3.70	0.75	4.50	10.40	5.4	0.077	0.010	20	40	330	11.0
IG10	900725	7.47	18.00	78.0	7.50	2.35	3.60	0.75	4.10	10.80	5.3			15	34	310	7.5
IG10	900821	7.26	18.40	80.0	7.50	2.30	3.40	0.70	3.90	10.40	5.3			10	28	330	14.5
IG10	900918	7.44	19.35	83.0	7.80	2.50	3.25	0.75	3.70	10.30	5.4	0.094	0.011	10	10	370	16.0
IG10	901102	7.39	20.00	85.0	8.30	2.60	3.70	0.75	3.60	10.30	4.9	0.042	0.004	15	14	280	12.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG11	880518	7.28	20.92	91.1	8.50	2.84	4.70	0.83	5.70	11.00	4.5	0.065		68	39	340	9.8
IG11	880720	7.51	20.06	85.8	8.00	2.44	3.80	0.80	4.29	10.95	4.8	0.056		5	15	310	14.0
IG11	880819	7.55	21.45	84.6	7.70	2.48	3.35	0.73	3.28	10.95	4.6	0.110		6	8	310	18.0
IG11	881006	7.51	21.38	86.0	7.59	2.43	3.29	0.70	3.80	11.50	4.8	0.089	0.007	0	3	260	12.3
IG11	881101	7.46	20.90	86.0	7.97	2.61	3.04	0.67	3.40	11.20	5.5	0.240		3	8	290	1.8
IG11	890517	7.46	17.30	88.0	7.23	2.20	4.45	0.85	7.90	10.40	4.5	0.087	0.012	80	66	420	9.0
IG11	890614	7.41	18.50	80.0	7.60	2.35	3.55	0.70	4.40	10.20	5.4	0.130	0.011	40	32	330	12.5
IG11	890719	7.46	18.30	80.0	7.30	2.35	3.65	0.75	4.50	10.60	5.8	0.041	0.007	60	62	340	11.5
IG11	890817	7.60	21.00	91.0	7.70	2.30	4.80	0.85	5.50	11.50	5.3	0.079	0.012	20	28	680	27.0
IG11	890914	7.60	19.30	83.0	7.60	2.45	3.95	0.80	4.40	10.50	5.2	0.066	0.010	20	42	450	19.5
IG11	900320	7.44	25.00	100.0	9.50	3.10	4.40	0.90	4.80	13.00	5.9	0.038	0.004	20	28	320	10.0
IG11	900504	7.21	14.80	77.0	6.00	2.05	4.50	0.85	6.20	8.90	4.5			100	80	470	18.0
IG11	900615	7.20	18.40	83.0	7.50	2.30	4.30	0.85	4.30	10.20	5.6	0.120	0.013	45	144	490	17.0
IG11	900726	7.44	19.70	83.0	8.00	2.40	3.90	0.80	4.40	10.30	5.5			25	34	380	8.0
IG11	900821	7.30	20.00	93.0	7.00	2.45	5.70	0.90	6.50	11.00	5.5	0.100	0.011	135	84	520	20.5
IG11	900917	7.35	19.60	84.0	7.90	2.55	3.40	0.75	3.80	10.30	5.4	0.130	0.008	10	18	380	12.5
IG11	901102	7.46	23.00	98.0	8.80	2.70	5.10	0.75	6.60	10.80	5.5	0.081	0.005	110	166	520	16.5
IG12	880518	7.11	17.31	73.8	7.60	2.58	2.74	0.67	2.50	11.00	4.9	0.074		55	14	300	12.1
IG12	880720	7.44	20.45	81.3	7.95	2.35	3.36	0.74	3.66	11.40	4.8	0.043		0	3	310	11.7
IG12	880819	7.41	20.34	82.4	7.45	2.39	3.39	0.75	3.40	10.50	4.3	0.066		11	11	320	16.5
IG12	881103	7.46	20.93	87.0	8.10	2.56	3.29	0.71	3.80	11.20	4.8	0.110		0	3	250	11.7
IG12	890516	7.06	12.90	60.0	5.85	1.80	2.05	0.60	2.10	9.40	5.0	0.140	0.022	40	36	350	12.5
IG12	890615	7.38	16.10	73.0	7.25	2.30	2.85	0.65	3.80	10.40	5.1	0.110	0.012	40	26	320	13.5
IG12	890720	7.46	18.00	76.0	7.10	2.25	3.05	0.70	4.30	10.90	5.1	0.048	0.006	40	36	290	10.0
IG12	890817	7.48	18.50	78.0	7.40	2.20	3.20	0.70	3.70	10.70	5.0	0.051	0.026	10	16	310	11.0
IG12	890914	7.56	19.00	77.0	7.40	2.40	3.20	0.75	3.30	11.10	5.0	0.066	0.020	0	12	300	15.0
IG12	900321	7.36	22.00	86.0	8.50	2.65	3.70	0.85	3.90	11.40	5.1	0.037	0.003	0	22	290	12.0
IG12	900504	7.20	19.40	82.0	8.00	2.50	3.30	0.75	5.10	11.30	4.4			60	26	330	10.5
IG12	900615	7.29	17.60	76.0	7.50	2.30	3.10	0.70	3.80	10.20	5.3	0.077	0.007	30	40	320	10.5
IG12	900726	7.47	18.00	77.0	0.80	2.35	3.20	0.70	3.30	10.30	5.2	0.048	0.007	10	28	300	8.0
IG12	900822	7.30	18.40	77.0	6.50	2.30	3.30	0.70	3.40	10.60	5.3	0.053	0.011	5	6		15.5
IG12	900918	7.37	18.30	80.0	7.70	2.50	3.00	0.75	3.40	10.50	5.2	0.084	0.014	10	10	360	14.5
IG12	901102	7.40	19.80	83.0	8.10	2.50	2.65	0.58	3.40	10.40	4.9	0.025	0.003	15	6	305	12.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG13	880518	7.12	17.66	75.1	7.70	2.60	2.78	0.69	2.70	11.00	4.9	0.064		55	15	300	12.2
IG13	880720	7.39	19.41	81.3	7.85	2.28	3.35	0.75	3.52	11.00	4.8	0.045		0	8	320	12.8
IG13	880819	7.41	20.22	82.5	7.45	2.38	3.37	0.75	3.48	10.50	4.4	0.064		12	15	290	16.9
IG13	881103	7.44	20.97	90.0	7.97	2.61	3.44	0.71	4.10	11.40	4.8	0.120		0	4	280	12.1
IG13	890516	7.11	15.00	68.0	6.50	2.00	2.60	0.60	2.70	10.20	5.1	0.120	0.029	40	16	365	11.0
IG13	890615	7.30	14.70	69.0	6.25	2.00	3.00	0.75	3.70	9.20	5.9	0.250	0.020	60	44	370	17.0
IG13	890720	7.44	18.30	77.0	7.10	2.25	3.15	0.70	3.60	10.40	4.9	0.054	0.010	40	30	300	12.0
IG13	890817	7.58	19.00	78.0	7.40	2.20	3.20	0.70	3.60	10.70	5.1	0.059	0.024	0	18	340	12.0
IG13	890914	7.60	19.30	78.0	7.80	2.40	3.30	0.75	3.40	11.80	4.9	0.062	0.016	0	8	310	14.5
IG13	900321	7.01	34.00	111.0	11.00	3.60	4.40	0.90	5.10	12.00	5.6	0.220	0.510	130	16	320	12.0
IG13	900504	7.25	19.40	82.0	8.00	2.45	3.40	0.75	4.00	12.60	4.3			40	30	320	11.0
IG13	900615	7.31	17.80	76.0	7.50	2.30	3.20	0.70	3.90	10.40	5.3	0.067	0.006	30	38	330	10.0
IG13	900726	7.56	18.60	78.0	8.00	2.40	3.40	0.75	3.60	10.40	5.2	0.049	0.005	15	24	310	5.5
IG13	900821	7.35	17.80	77.0	6.50	2.30	3.40	0.70	3.60	10.40	5.1	0.061	0.012	10	12	300	14.0
IG13	900918	7.45	19.40	82.0	8	2.6	3.1	0.75	3.4	10.5	6.2	0.081	0.012	10	10	370	15.5
IG13	901102	7.44	20.00	83.0	8.1	2.5	2.7	0.65	3.4	10.4	4.9	0.028	0.002	10	12	290	10.5
IG14	880518	7.10	15.82	70.3	6.70	2.28	3.02	0.75	3.20	10.10	4.8	0.110		67	16	310	13.4
IG14	880720	7.50	19.44	81.2	7.85	2.29	3.39	0.74	3.82	11.15	4.7	0.035		0	3	290	12.3
IG14	880816	7.54	19.38	84.4	7.35	2.33	3.43	0.77	3.83	10.30	4.6	0.076		6	4	320	16.3
IG14	881101	7.42	20.00	84.0	7.68	2.53	3.18	0.73	3.80	11.00	5.2	0.120		0	4	240	6.9
IG14	890516	6.99	10.70	60.0	5.05	1.55	2.98	0.75	3.60	8.90	5.0	0.260	0.034	10	12	345	11.0
IG14	890615	7.39	17.10	74.0	7.20	2.30	3.05	0.65	3.40	10.50	5.2	0.077	0.010	40	28	300	10.0
IG14	890720	7.44	17.70	75.0	7.20	2.25	3.25	0.70	3.60	10.30	5.2	0.064	0.013	30	36	310	11.5
IG14	890817	7.59	18.30	78.0	7.70	2.30	3.30	0.75	3.70	10.60	5.0	0.078	0.020	0	16	350	17.0
IG14	890914	7.67	18.30	78.0	7.50	2.35	3.35	0.75	3.50	11.60	5.0	0.056	0.025	0	10	310	13.0
IG14	900321	6.65	7.20	50.0	4.00	1.20	2.60	0.90	3.20	7.70	5.5	0.660	0.077	370	80	400	26.0
IG14	900504	7.27	14.50	69.0	6.00	2.00	3.00	0.75	3.70	9.70	4.2			100	22	280	11.0
IG14	900615	7.37	17.50	77.0	7.50	2.30	3.40	0.70	4.30	10.40	5.1	0.075	0.008	20	28	320	9.0
IG14	900726	7.55	19.60	78.0	7.50	2.40	3.60	0.75	3.70	10.40	5.2	0.061	0.010	15	26	300	7.5
IG14	900821	7.35	18.00	79.0	6.50	2.25	3.60	0.75	3.90	10.20	5.1	0.046	0.011	5	20	360	17.5
IG14	900918	7.36	18.20	80.0	7.50	2.45	3.30	0.80	3.70	10.30	5.6	0.130	0.016	10	10	370	14.0
IG14	901102	7.49	20.00	84.0	8.10	2.50	3.10	0.60	3.40	10.40	4.9	0.048	0.004	10	6	300	12.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG15	880518	7.13	18.34	77.8	7.90	2.62	3.22	0.73	3.30	10.80	4.6	0.044		64	15	310	10.3
IG15	880720	7.46	19.35	81.1	7.80	2.24	3.39	0.75	3.60	10.85	4.7	0.033		0	3	340	10.4
IG15	880816	7.39	19.77	82.8	7.40	2.37	3.40	0.76	3.16	10.30	4.4	0.059		9	5	340	16.6
IG15	881101	7.44	20.80	89.0	8.10	2.54	3.29	0.73	3.80	11.10	4.9	0.099		0	5	240	12.6
IG15	890516	7.25	16.90	77.0	5.15	2.25	3.10	0.70	3.70	10.80	5.1	0.110	0.063	70	18	310	10.5
IG15	890615	7.45	17.00	75.0	7.25	2.30	3.30	0.70	3.70	10.20	5.0	0.083	0.011	50	30	320	11.5
IG15	890720	7.40	17.70	76.0	7.30	2.25	3.20	0.70	3.70	10.30	5.1	0.051	0.010	40	38	310	10.5
IG15	890817	7.55	18.50	78.0	7.70	2.30	3.20	0.75	3.60	10.40	5.0	0.049	0.017	0	16	320	11.5
IG15	890914	7.65	18.20	77.0	7.40	2.40	3.30	0.75	3.50	11.80	5.0	0.055	0.023	0	10	320	14.5
IG15	900320	6.18	4.00	13.0	1.00	0.19	0.50	0.15	0.60	1.30	0.5	0.000	0.007	110	86	170	6.0
IG15	900504	7.39	18.80	80.0	7.50	2.35	3.40	0.75	4.00	10.50	4.2			50	26	280	13.0
IG15	900615	7.36	17.40	76.0	7.50	2.30	3.40	0.70	3.90	12.80	5.4	0.076	0.006	30	36	310	8.5
IG15	900726	7.51	19.10	80.0	7.50	2.40	3.60	0.70	3.30	10.10	5.3	0.050	0.005	20	28	310	7.5
IG15	900821	7.43	18.80	78.0	7.00	2.30	3.50	0.70	3.90	10.60	5.2	0.040	0.010	5	26	360	17.0
IG15	900918	7.41	18.70	81.0	7.60	2.50	3.30	0.74	3.70	10.50	5.6	0.073	0.015	10	6	400	17.0
IG15	901102	7.45	20.00	82.0	8.10	2.50	3.40	0.65	3.50	10.30	5.0	0.028	0.003	10	2	310	12.5
IG16	880518	7.32	23.44	80.0	8.70	3.34	2.36	0.89	2.70	9.25	5.9	0.140		4	14	500	33.0
IG16	880713	7.87		79.5	8.50	2.77	2.38	0.63	2.20	10.30	5.9	0.051		0	16	390	17.0
IG16	880816	8.69	22.30	78.6	7.90	2.61	2.37	0.24	1.69	9.10	5.7	0.150		2	3	580	30.0
IG16	881101	7.50	39.43	121.0	12.90	4.46	2.59	1.57	3.50	10.80	8.9	0.480		29	16	600	50.5
IG16	890517	7.34	25.90	78.0	8.05	2.85	1.95	1.10	2.70	6.00	4.7	0.140	0.008	0	72	550	41.5
IG16	890614	7.48	17.60	71.0	7.05	2.35	2.45	0.75	2.60	9.20	5.3	0.230	0.013	0	28	370	22.5
IG16	890719	7.54	20.00	76.0	7.80	2.55	2.50	0.75	2.50	9.60	5.8	0.220	0.021	20	42	390	23.0
IG16	890817	7.82	23.00	83.0	0.84	2.60	2.50	0.55	2.40	9.20	6.1	0.096	0.020	0	18	450	18.0
IG16	890914	7.92	24.00	81.0	8.50	2.85	2.65	0.50	2.50	10.00	5.6	0.059	0.012	0	26	390	16.0
IG16	900321	7.32	55.00	151.0	17.50	6.00	3.00	1.60	2.80	10.40	6.4	0.480	0.021	730	92	620	58.0
IG16	900504	7.45	21.00	77.0	8.00	2.80	2.20	0.90	2.80	9.30	5.2			0	72	410	13.5
IG16	900615	7.30	20.50	73.0	8.00	2.65	2.10	0.90	2.40	9.30	7.3	0.210	0.018	15	46	480	24.0
IG16	900725	7.42	21.00	76.0	8.00	2.70	2.40	0.80	2.20	9.10	7.0	0.110	0.017	10	36	440	18.5
IG16	900822	7.46	19.75	74.0	7.00	2.55	2.25	0.55	2.20	9.30	6.6	0.110	0.010	5	300	410	16.5
IG16	900917	7.49	21.00	77.0	8.00	2.70	2.20	0.55	2.20	9.30	6.0	0.090	0.011	10	24	390	15.0
IG16	901031	7.49	28.00	92.0	10.20	3.45	2.83	1.05	3.00	10.00	6.8	0.150	0.008	20	28	450	21.5

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG17	880518	7.17	18.65	70.0	7.30	2.76	2.10	0.80	2.20	9.30	5.1	0.099		4	22	410	22.0
IG17	880713	7.71		74.1	7.65	2.45	2.36	0.57	2.16	10.15	5.6	0.100		0	9	350	16.0
IG17	880816	8.11	19.06	76.3	7.10	2.35	2.72	0.34	2.02	10.10	5.0	0.130		3	5	340	18.5
IG17	881101	7.27	20.38	83.0	7.97	2.53	2.79	0.79	3.30	10.70	5.3	0.280		0	2	330	19.5
IG17	890517	7.26	15.80	60.0	5.85	2.00	1.90	0.90	2.50	7.10	4.5	0.140	0.010	0	34	400	20.5
IG17	890614	7.42	16.90	69.0	6.90	2.25	2.40	0.75	2.60	9.20	5.4	0.190	0.013	0	30	390	23.5
IG17	890719	7.46	18.50	72.0	7.20	2.35	2.45	0.70	2.50	9.60	6.0	0.180	0.018	20	44	400	21.5
IG17	890817	7.60	20.00	75.0	7.70	2.35	2.55	0.60	2.50	10.00	5.6	0.150	0.014	0	14	360	15.0
IG17	890914	7.55	19.80	75.0	7.40	2.50	2.80	0.65	2.70	11.40	5.2	0.238	0.020	0	24	350	15.5
IG17	900321	6.77	17.00	77.0	6.50	2.85	2.80	1.75	3.40	9.00	7.6	0.630	0.043	680	126	720	57.0
IG17	900504	7.37	16.90	71.0	7.00	2.35	2.40	0.80	2.90	10.10	5.3			20	58	380	9.5
IG17	900615	7.13	16.60	67.0	7.00	2.30	2.00	0.75	2.10	10.40	6.9	0.260	0.014	15	44	410	17.0
IG17	900725	7.49	19.40	72.0	7.50	2.45	2.50	0.70	2.10	9.50	6.4	0.150	0.017	10	26	410	17.0
IG17	900822	7.45	18.80	73.0	7.00	2.45	2.40	0.60	2.20	9.30	6.4	0.083	0.009	5	28	360	13.5
IG17	900917	7.68	26.00	76.0	7.60	2.50	2.40	0.70	2.50	10.00	5.8	0.190	0.013	10	22	310	13.0
IG17	901031	7.43	22.00	82.0	8.70	2.85	2.95	0.90	3.10	10.40	6.4	0.160	0.009	20	28	390	19.5
IG18	880518	7.07	17.41	65.7	6.70	2.76	1.92	0.68	1.80	8.60	5.7	0.130		4	20	400	22.0
IG18	880713	7.25		75.2	7.65	2.52	2.46	0.70	2.40	10.45	5.4	0.083		0	17	360	17.0
IG18	880816	7.47	19.76	76.0	7.00	2.37	2.69	0.48	2.84	9.35	5.0	0.058		9	15	370	16.0
IG18	881101	7.27	20.16	75.0	7.25	2.73	1.85	0.64	2.20	9.40	5.5	0.210		0	6	360	19.0
IG18	890517	7.38	15.70	61.0	5.85	2.20	1.75	0.75	2.00	8.00	5.9	0.130	0.011	0	22	405	11.5
IG18	890615	7.47	17.00	64.0	6.45	2.35	1.90	0.70	2.10	8.00	6.2	0.130	0.014	0	18	440	17.5
IG18	890719	7.47	17.80	69.0	6.80	2.30	2.30	0.65	2.40	9.40	5.7	0.120	0.016	10	32	370	18.0
IG18	890817	7.50	18.40	71.0	7.10	2.25	2.40	0.55	2.40	9.40	5.6	0.064	0.008	0	12	340	11.0
IG18	890914	7.58	18.70	71.0	6.70	2.45	2.50	0.55	2.50	10.40	5.3	0.034	0.006	0	22	350	13.0
IG18	900321	6.99	25.00	81.0	8.00	3.10	2.20	0.90	2.40	8.50	6.2	0.087	0.024	60	24	420	14.0
IG18	900504	7.18	17.20	69.0	7.00	2.35	2.30	0.75	2.60	9.40	5.7			20	54	410	10.0
IG18	900615	7.21	17.60	66.0	7.00	2.50	1.90	0.80	2.20	8.20	6.8	0.270	0.015	15	42	460	23.5
IG18	900725	7.38	18.90	71.0	7.00	2.50	2.40	0.70	2.10	9.10	6.5	0.120	0.021	10	34	400	16.5
IG18	900822	7.39	18.70	71.0	6.50	2.55	2.10	0.70	2.40	8.80	6.6	0.110	0.011	5	24	390	15.5
IG18	900917	7.31	18.80	72.0	7.20	2.60	2.40	0.70	2.50	9.00	5.9	0.067	0.011	10	24	360	13.0
IG18	901031	7.31	18.20	67.0	7.00	2.55	2.15	0.75	2.10	8.40	6.5	0.130	0.014	20	24	380	16.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG19	880518	7.17	17.97	67.0	6.80	2.84	1.92	0.70	1.90	8.65	5.6	0.130		4	16	440	22.5
IG19	880713	7.39		73.1	7.50	2.62	2.12	0.72	2.20	9.65	5.9	0.120		0	16	500	21.0
IG19	880816	7.44	19.98	75.0	7.05	2.47	2.43	0.53	4.20	8.95	5.3	0.060		8	11	400	17.5
IG19	881101	7.26	18.07	77.0	7.25	2.70	2.02	0.74	2.40	9.70	5.8	0.088		0	6	370	23.5
IG19	890517	7.45	15.80	62.0	5.85	2.30	1.75	0.70	2.00	8.00	6.3	0.130	0.010	0	24	410	13.0
IG19	890615	7.47	16.70	64.0	6.35	2.40	1.85	0.70	2.00	7.80	6.2	0.140	0.009	0	20	420	19.0
IG19	890719	7.45	17.90	69.0	7.00	2.35	2.15	0.65	2.10	9.10	5.9	0.094	0.014	20	28	350	15.5
IG19	890817	7.55	19.40	69.0	6.90	2.40	1.95	0.65	2.00	8.00	6.2	0.065	0.008	0	14	430	14.5
IG19	890914	7.52	20.00	69.0	6.70	2.65	2.05	0.65	2.10	9.00	6.2	0.103	0.015	0	28	440	18.0
IG19	900321	6.95	24.00	78.0	8.00	3.00	2.10	0.85	2.40	8.20	6.4	0.150	0.017	80	18	420	16.0
IG19	900504	7.30	17.60	64.0	6.50	2.35	1.80	0.70	2.10	7.60	5.4			0	38	410	22.0
IG19	900615	7.32	17.50	67.0	7.00	2.55	1.90	0.80	2.30	8.20	6.9	0.430	0.018	15	56	500	28.0
IG19	900725	7.48	19.50	71.0	7.50	2.65	2.30	0.80	2.30	8.60	6.5	0.110	0.011	5	30	430	17.5
IG19	900822	7.43	18.90	71.0	6.50	2.60	2.00	0.80	2.30	8.20	7.0	0.120	0.011	5	20	390	15.5
IG19	900917	7.43	19.60	73.0	7.30	2.70	2.00	0.80	2.30	8.50	6.8	0.130	0.011	10	32	450	17.5
IG19	901031	7.33	18.50	67.0	7.10	2.60	2.05	0.80	2.10	8.60	6.4	0.110	0.011	20	24	360	15.5
IG20	880518	7.11	15.67	65.1	6.70	2.48	1.98	0.72	1.90	9.80	5.0	0.120		10	28	360	19.0
IG20	880713	7.92		77.9	7.90	2.44	2.88	0.71	2.80	11.80	5.1	0.070		0	6	310	13.3
IG20	880819	7.50	19.93	77.4	7.20	2.33	3.22	0.70	3.18	10.80	4.6	0.810		2	9	370	16.3
IG20	881103	7.36	21.23	88.0	8.10	2.65	2.84	0.74	3.10	11.00	5.8	0.510		5	3	390	31.0
IG20	890517	7.29	13.90	62.0	6.40	1.95	2.10	0.65	2.10	9.40	5.9	0.170	0.015	0	16	340	10.5
IG20	890615	7.39	17.30	68.0	6.90	2.25	2.30	0.70	2.40	9.60	5.6	0.490	0.022	10	30	380	33.5
IG20	890720	7.51	17.40	72.0	7.20	2.25	2.60	0.70	2.50	10.40	5.2	0.390	0.018	20	32	340	23.5
IG20	890817	7.49	18.70	76.0	7.50	2.20	2.90	0.70	3.00	10.60	5.0	0.180	0.009	0	16	310	13.0
IG20	890914	7.58	18.40	76.0	7.30	2.40	3.05	0.70	3.00	12.00	4.9	0.119	0.007	0	20	310	13.0
IG20	900321	7.09	24.00	134.0	10.00	3.70	8.40	2.05	15.00	11.20	7.0	0.900	0.075	1020	210	820	76.0
IG20	900504	7.00	9.30	49.0	5.00	1.50	1.50	0.55	1.10	9.10	5.9			80	14	320	14.0
IG20	900615	7.33	16.50	69.0	7.00	2.30	2.30	0.70	2.50	10.00	6.6	0.250	0.012	20	42	370	15.0
IG20	900725	7.52	19.20	75.0	7.50	2.40	2.80	0.70	2.50	10.00	5.8	0.063	0.008	5	18	330	11.5
IG20	900822	7.33	19.00	76.0	7.00	2.40	2.80	0.65	2.50	11.00	6.5	0.096	0.014	5	20	330	13.0
IG20	900917	7.44	19.40	77.0	7.60	2.50	2.50	0.65	2.70	10.00	5.8	0.097	0.011	10	18	310	11.5
IG20	901102	7.47	20.00	82.0	8.10	2.50	3.20	0.64	3.50	10.40	48.0	0.039	0.004	15	18	320	12.5

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG21	880518	7.06	14.70	65.8	6.90	2.28	2.18	0.60	1.80	10.80	5.8	0.120		47	20	320	15.8
IG21	880713	7.36		79.5	7.85	2.39	3.18	0.75	3.20	10.65	4.8	0.054		0	8	280	10.4
IG21	880816	7.41	20.00	81.0	7.45	2.33	3.34	0.76	4.09	10.00	4.6	0.088		18	15	310	13.9
IG21	881006	7.36	20.11	85.0	7.45	2.31	3.10	0.62	3.00	11.60	5.4	0.460	0.024	3	5	310	20.0
IG21	881103	7.45	20.43	86.0	7.82	2.57	3.18	0.69	3.40	11.10	4.9	0.190		0	1	280	15.7
IG21	890516	7.10	11.40	57.0	5.85	1.70	1.95	0.55	1.70	9.70	5.2	0.130	0.025	50	20	285	11.0
IG21	890615	7.48	16.80	63.0	6.50	2.00	1.85	0.50	1.50	10.00	7.0	0.390	0.027	30	10	360	22.5
IG21	890720	7.33	17.50	73.0	7.20	2.25	2.70	0.70	2.70	10.80	5.4	0.520	0.022	40	34	370	32.0
IG21	890817	7.46	18.80	78.0	7.60	2.20	3.15	0.75	3.50	10.40	5.1	0.062	0.030	10	18	310	12.0
IG21	890914	7.58	19.20	78.0	7.10	2.40	3.00	0.70	3.10	12.20	5.0	0.211	0.011	0	24	310	15.0
IG21	900321	7.07	20.00	104.0	8.50	3.20	5.20	1.85	8.70	11.20	7.1	0.730	0.063	920	174	750	63.0
IG21	900504	7.16	17.30	76.0	7.50	2.35	2.80	7.00	2.80	11.20	5.5			90	30	340	14.0
IG21	900615	7.40	16.80	74.0	7.00	2.30	2.70	0.70	3.20	9.90	5.6	0.130	0.010	25	36	320	10.0
IG21	900725	7.46	18.20	74.0	7.50	2.30	2.80	0.65	2.60	10.00	5.5	0.064	0.008	5	24	300	10.0
IG21	900821	7.42	18.20	76.0	6.50	2.45	3.00	0.65	3.10	10.40	5.5	0.053	0.009	5	24	300	12.0
IG21	900918	7.46	19.70	79.0	7.40	2.40	2.70	0.75	3.10	10.50	7.5	0.120	0.014	10	14	280	12.0
IG21	901031	7.35	21.00	78.0	8.30	2.70	2.85	0.75	2.90	10.40	6.6	0.180	0.012	40	22	310	16.0
IG22	880518	7.30	19.21	77.1	7.90	2.66	2.98	0.69	3.00	10.80	4.8	0.066		47	16	310	12.8
IG22	880713	7.34		80.7	8.05	2.44	3.22	0.74	3.20	10.60	4.8	0.070		0	18	280	13.8
IG22	880816	7.30	19.87	81.3	7.40	2.35	3.38	0.76	3.19	10.15	4.4	0.068		15	11	300	13.8
IG22	881006	7.55	21.16	84.0	7.74	2.46	3.29	0.70	3.70	11.50	4.7	0.093	0.010	0	2	240	10.1
IG22	881103	7.51	20.76	85.0	7.82	2.59	3.24	0.64	3.70	11.20	4.7	0.091		0	2	280	9.9
IG22	890516	7.45	19.90	84.0	8.20	2.55	3.70	0.65	4.10	11.20	4.5	0.069	0.050	30	12	275	8.0
IG22	890614	7.43	17.50	76.0	7.15	2.30	2.80	0.65	3.30	10.50	5.1	0.110	0.012	50	28	300	12.0
IG22	890720	7.44	18.30	75.0	7.40	2.25	2.90	0.70	2.60	11.00	5.7	0.180	0.014	40	30	330	15.0
IG22	890914	7.60	19.00	79.0	7.10	2.40	3.25	0.70	3.50	10.60	4.8	0.074	0.020	0	12	310	14.0
IG22	900321	7.02	20.00	85.0	8.50	2.50	3.40	0.70	2.50	13.20	7.0	0.068	0.015	10	12	340	8.5
IG22	900504	7.27	21.00	91.0	8.50	2.65	4.30	0.75	5.40	11.30	4.5			60	36	310	13.5
IG22	900615	7.30	17.60	72.0	7.50	2.30	2.50	0.65	2.70	10.10	6.1	0.240	0.015	20	40	360	14.5
IG22	900725	7.45	17.80	75.0	7.50	2.30	3.00	0.65	2.90	10.40	5.5	0.060	0.007	10	26	320	10.5
IG22	900821	7.42	18.30	78.0	7.00	2.45	3.50	0.70	3.40	10.60	5.3	0.078	0.010	5	26	320	14.0
IG22	900918	7.39	18.70	78.0	7.50	2.45	2.80	0.75	3.20	10.00	5.4	0.110	0.013	10	8	300	13.5
IG22	901031	7.42	20.00	82.0	8.30	2.60	3.05	0.75	3.10	11.10	6.7	0.100	0.007	30	14	320	14.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG23	880518	7.17	19.02	79.1	8.10	2.72	3.10	0.70	3.10	11.10	4.6	0.045		63	22	290	10.1
IG23	880713	7.42		80.8	8.10	2.45	3.24	0.73	3.40	10.65	4.8	0.050		0	7	270	9.9
IG23	880819	7.37	20.43	83.1	7.50	2.40	3.36	0.75	3.46	10.65	4.5	0.073		10	15	300	17.5
IG23	881006	7.53	20.97	88.0	7.59	2.51	3.42	0.75	3.80	11.40	4.6	0.077	0.014	0	2	240	11.7
IG23	881103	7.48	21.00	88.0	7.97	2.63	3.27	0.74	3.90	11.20	4.8	0.120		0	2	250	11.8
IG23	890516	7.26	19.60	73.0	7.20	2.25	2.90	0.65	3.10	10.70	6.2	0.100	0.052	50	34	325	10.5
IG23	890614	7.43	17.40	76.0	7.25	2.30	3.15	0.70	3.70	10.30	5.1	0.074	0.010	50	28	300	10.0
IG23	890719	7.56	18.70	78.0	7.60	2.40	0.30	0.65	3.60	10.70	5.1	0.057	0.005	60	36	300	10.5
IG23	890817	7.49	19.20	79.0	7.70	2.35	3.15	0.70	3.30	10.70	5.1	0.073	0.014	0	22	310	11.0
IG23	890914	7.63	19.20	78.0	7.10	2.40	3.25	0.75	3.50	10.60	5.0	0.058	0.014	0	14	310	13.0
IG23	900320	7.30	23.00	88.0	8.50	2.65	3.70	0.80	3.60	11.20	4.9	0.035	0.005	0	16	280	9.0
IG23	900504	7.41	20.00	86.0	8.00	2.55	3.80	0.70	4.40	11.00	5.1			20	46	290	8.5
IG23	900615	7.30	17.40	75.0	7.00	2.30	3.00	0.70	3.40	8.00	5.5	0.084	0.005	25	46	330	14.5
IG23	900725	7.55	18.80	78.0	7.50	2.40	3.20	0.75	3.40	10.40	5.0	0.073	0.006	15	28	280	10.0
IG23	900821	7.43	18.20	78.0	6.50	2.50	3.50	0.70	3.70	10.40	5.2	0.060	0.011	5	34	320	16.5
IG23	900918	7.45	19.00	81.0	7.60	2.45	3.00	0.80	3.60	10.30	5.3	0.087	0.015	10	10	360	15.5
IG23	901031	7.46	20.00	80.0	8.00	2.55	3.35	0.75	3.60	11.00	5.0	0.071	0.009	20	10	260	13.5
IG24	880518	7.18	19.50	80.3	8.10	2.70	3.14	0.72	3.30	11.00	4.5	0.047		56	21	280	9.6
IG24	880713	7.43		80.9	8.15	2.45	3.27	0.74	3.40	10.90	4.8	0.054		0	5	260	11.5
IG24	880819	7.47	20.27	82.5	7.50	2.37	3.34	0.74	3.39	10.40	4.3	0.077		7	9	300	16.0
IG24	881006	7.51	20.80	89.0	7.59	2.43	3.37	0.68	3.80	11.40	4.7	0.083	0.012	0	2	240	10.8
IG24	881103	7.48	20.93	85.0	7.97	2.59	3.21	0.71	3.70	11.00	4.8	0.110		0	1	250	11.3
IG24	890516	7.27	19.40	80.0	7.95	2.45	3.28	0.70	3.60	11.40	4.8	0.088	0.067	50	28	290	10.5
IG24	890614	7.44	17.40	75.0	7.20	2.30	2.90	0.65	3.10	10.40	5.3	0.100	0.010	45	26	310	13.0
IG24	890720	7.49	18.20	76.0	7.40	2.30	3.10	0.70	3.20	10.50	5.0	0.071	0.007	60	38	300	10.0
IG24	890817	7.51	19.50	78.0	7.70	2.35	3.15	0.70	3.30	10.70	5.3	0.071	0.016	0	22	320	9.5
IG24	890914	7.66	21.00	81.0	7.30	2.55	3.25	0.75	3.40	10.60	4.8	0.081	0.009	0	16	310	12.0
IG24	900320	7.37	23.00	88.0	8.50	2.75	3.75	0.80	3.50	11.90	5.4	0.027	0.004	0	20	310	9.0
IG24	900504	7.18	17.80	78.0	7.50	2.35	3.00	0.70	3.00	11.40	5.2			60	24	340	12.5
IG24	900615	7.30	17.10	73.0	7.00	2.30	2.70	0.65	3.10	10.90	5.8	0.120	0.006	20	32	290	9.5
IG24	900725	7.48	18.80	75.0	7.50	2.35	2.90	0.70	3.00	10.40	5.4	0.074	0.007	10	28	310	11.0
IG24	900821	7.30	18.25	79.0	7.00	2.50	3.40	0.70	3.60	10.60	5.3	0.098	0.011	5	22	300	14.0
IG24	900918	7.35	19.00	80.0	7.60	2.50	2.90	0.75	3.40	10.60	5.4	0.085	0.012	10	6	300	13.5
IG24	901031	7.44	20.00	81.0	8.20	2.55	3.35	0.75	2.80	10.80	5.0	0.082	0.009	10	6	310	10.0

STN	SDATE	PH	ALK	COND	CA	MG	NA	K	CLI	SO4	DOC	FE	MN	NNO	NNH	NNT	P(ave)
IG25	880518	6.92	16.16	70.6	7.30	2.44	2.52	0.68	2.40	10.80	5.1	0.070		92	25	320	12.3
IG25	880713	7.28		77.8	7.70	2.31	3.10	0.72	3.00	10.30	4.9	0.030		0	10	280	9.3
IG25	880816	7.28	18.82	78.4	7.10	2.22	3.19	0.74	3.02	10.10	4.6	0.030		16	9	270	9.6
IG25	881101	7.34	20.45	83.0	7.68	2.48	3.10	0.73	3.50	11.00	4.9	0.065		2	7	270	13.0
IG25	890516	7.09	17.75	77.0	7.95	2.35	2.80	0.70	2.60	12.20	5.1	0.100	0.065	110	24	355	13.5
IG25	890614	7.40	16.50	75.0	7.25	0.65	2.85	0.65	3.20	10.50	5.2	0.053	0.012	30	30	320	9.0
IG25	890719	7.48	16.20	75.0	7.40	2.30	3.10	0.70	3.10	10.70	5.3	0.043	0.010	30	32	300	14.5
IG25	890817	7.51	18.10	75.0	7.40	2.25	3.00	0.70	3.20	10.70	5.2	0.030	0.014	0	10	310	6.0
IG25	890914	7.50	18.10	78.0	7.30	2.30	3.10	0.70	3.30	10.40	4.8	0.072	0.017	10	12	290	9.5
IG25	900321	7.02	23.00	85.0	0.85	2.70	3.50	0.80	3.20	11.50	5.5	0.087	0.039	50	20	290	12.0
IG25	900504	7.11	19.70	83.0	8.00	2.55	3.10	0.70	2.90	12.20	5.3			40	20	330	13.5
IG25	900615	7.30	17.40	76.0	7.00	2.30	3.10	0.70	3.70	10.20	5.3	0.049	0.010	20	44	300	10.0
IG25	900725	7.46	18.00	76.0	7.50	2.30	3.10	0.70	3.20	10.20	5.3	0.043	0.010	10	32	300	9.0
IG25	900822	7.13	17.20	77.0	6.50	2.45	3.30	0.70	3.60	10.20	5.2	0.031	0.017	5	28	280	11.5
IG25	900917	7.32	18.20	78.0	7.30	2.35	2.90	0.70	3.40	10.30	5.2	0.071	0.031	10	18	290	12.5
IG25	901031	7.38	19.80	79.0	8.05	2.53	3.35	0.78	3.70	10.90	5.0	0.070	0.017	10	10	300	16.5
IG26	880518	6.99	17.12	68.1	7.00	2.48	2.46	0.68	2.10	10.60	5.6	0.066		37	28	370	13.8
IG26	880713	7.28		76.7	7.65	2.33	2.95	0.71	3.00	10.50	5.1	0.029		0	10	270	10.0
IG26	880816	7.19	18.86	78.6	7.10	2.20	3.18	0.72	3.28	9.85	4.7	0.022		17	15	260	10.6
IG26	881101	7.26	19.31	83.0	7.54	2.41	2.95	0.74	3.30	10.70	4.9	0.140		0	4	250	10.6
IG26	890516	7.16	17.10	74.0	7.15	2.30	2.60	0.70	2.40	11.80	5.6	0.091	0.056	80	36	325	12.0
IG26	890614	7.40	16.90	72.0	7.05	0.60	2.75	0.65	2.80	10.40	5.4	0.054	0.016	20	36	340	13.0
IG26	890719	7.50	17.40	74.0	7.30	2.25	3.00	0.65	3.10	10.50	5.1	0.042	0.010	20	26	290	10.0
IG26	890817	7.50	18.10	75.0	7.30	2.20	2.95	0.70	3.30	10.60	5.1	0.028	0.013	0	8	310	6.5
IG26	890914	7.49	18.10	76.0	7.30	2.30	3.10	0.70	3.20	10.40	4.9	0.024	0.012	0	14	290	9.5
IG26	900321	6.64	16.80	62.0	6.00	2.40	1.90	0.85	1.60	8.00	8.6	0.390	0.078	200	100	560	22.5
IG26	900504	7.13	16.00	67.0	6.50	2.25	2.30	0.70	3.30	10.20	5.6			20	38	390	17.0
IG26	900615	7.32		72.0	7.00	2.30	2.70	0.65	2.80	9.80	6.0	0.059	0.013	15	38	320	10.0
IG26	900725	7.53	18.60	76.0	7.00	2.30	3.10	0.70	3.10	10.20	5.2	0.000	0.004	5	34	300	9.0
IG26	900822	7.26	17.40	76.0	6.50	2.40	3.30	0.70	3.50	10.20	5.3	0.044	0.016	5	28	300	14.0
IG26	900917	7.29	18.40	77.0	7.40	2.35	3.00	0.75	3.40	10.00	5.4	0.058	0.027	20	16	270	11.0
IG26	901031	7.29	17.60	72.0	7.40	2.35	2.80	0.75	2.90	10.10	6.0	0.074	0.027	20	26	330	13.5

Appendix C: Summary of Seasonally Variable Parameters: Phosphorus, Chlorophyll and Inorganic Nitrogen

Nipissing Phosphorous

IG1

	1988	1989	1990	min	max	avg
MAY	12.1	12.5	16.0	12.1	16.0	13.5
JUNE		14.5	13.5	13.5	14.5	14.0
JULY	12.0	11.0	8.5	8.5	12.0	10.5
AUG	10.7	10.5	11.5	10.5	11.5	10.9
SEPT		15.5	14.5	14.5	15.5	15.0
OCT	10.7		11.0	10.7	11.0	10.9
NOV	15.3			15.3	15.3	15.3
min	10.7	10.5	8.5			
max	15.3	15.5	16.0			
avg	12.2	12.8	12.5			12.5

IG2

	1988	1989	1990	min	max	avg
MAY	12.2	10.0	13.0	10.0	13.0	11.7
JUNE		15.5	15.0	15.0	15.5	15.3
JULY	8.4	11.5	11.0	8.4	11.5	10.3
AUG	16.8	11.0	12.5	11.0	16.8	13.4
SEPT		16.5	12.5	12.5	16.5	14.5
OCT			24.0	24.0	24.0	24.0
NOV	22.0			22.0	22.0	22.0
min	8.4	10.0	11.0			
max	22.0	16.5	24.0			
avg	14.9	12.9	14.7			14.1

IG3

	1988	1989	1990	min	max	avg
MAY	10.7	11.0	11.5	10.7	11.5	11.1
JUNE		13.5	17.0	13.5	17.0	15.3
JULY	4.9	13.0	8.5	4.9	13.0	8.8
AUG	16.5	12.0	12.5	12.0	16.5	13.7
SEPT		12.5	7.5	7.5	12.5	10.0
OCT			16.0	16.0	16.0	16.0
NOV	22.0			22.0	22.0	22.0
min	4.9	11.0	7.5			
max	22.0	13.5	17.0			
avg	13.5	12.4	12.2			12.6

IG4

	1988	1989	1990	min	max	avg
MAY	13.2	8.5	14.0	8.5	14.0	11.9
JUNE		18.0	13.5	13.5	18.0	15.8
JULY	13.2	19.0	11.0	11.0	19.0	14.4
AUG	15.2	11.5	15.0	11.5	15.2	13.9
SEPT		13.5	10.5	10.5	13.5	12.0
OCT	19.0		15.0	15.0	19.0	17.0
NOV	24.5			24.5	24.5	24.5
min	13.2	8.5	10.5			
max	24.5	19.0	15.0			
avg	17.0	14.1	13.2			14.7

IG5

	1988	1989	1990	min	max	avg
MAY	13.9	9.5	13.5	9.5	13.9	12.3
JUNE		15.0	14.0	14.0	15.0	14.5
JULY	11.4	18.0	16.5	11.4	18.0	15.3
AUG	18.5	13.5	11.0	11.0	18.5	14.3
SEPT		14.0	14.0	14.0	14.0	14.0
OCT			14.0	14.0	14.0	14.0
NOV	15.6			15.6	15.6	15.6
min	11.4	9.5	11.0			
max	18.5	18.0	16.5			
avg	14.9	14.0	13.8			14.2

IG6

	1988	1989	1990	min	max	avg
MAY	13.3	10.0	18.0	10.0	18.0	13.8
JUNE		14.0	11.5	11.5	14.0	12.8
JULY	20.0	13.5	16.5	13.5	20.0	16.7
AUG	16.3	13.5	12.0	12.0	16.3	13.9
SEPT		10.0	22.5	10.0	22.5	16.3
OCT			8.0	8.0	8.0	8.0
NOV	11.6			11.6	11.6	11.6
min	11.6	10.0	8.0			
max	20.0	14.0	22.5			
avg	15.3	12.2	14.8			14.0

Nipissing Phosphorous

IG7

	1988	1989	1990	min	max	avg
MAY	43.0	35.5	31.0	31.0	43.0	36.5
JUNE		29.0	37.5	29.0	37.5	33.3
JULY	20.0	28.5	25.5	20.0	28.5	24.7
AUG	48.5	24.0	27.5	24.0	48.5	33.3
SEPT		21.0	20.5	20.5	21.0	20.8
OCT			36.0	36.0	36.0	36.0
NOV	33.0			33.0	33.0	33.0
min	20.0	21.0	20.5			
max	48.5	35.5	37.5			
avg	36.1	27.6	29.7			30.7

IG8

	1988	1989	1990	min	max	avg
MAY	10.4	11.5	12.0	10.4	12.0	11.3
JUNE		10.5	12.0	10.5	12.0	11.3
JULY	9.6	9.5	8.0	8.0	9.6	9.0
AUG	24.0	11.0	14.0	11.0	24.0	16.3
SEPT		16.0	13.0	13.0	16.0	14.5
OCT	12.6		12.5	12.5	12.6	12.6
NOV	12.3			12.3	12.3	12.3
min	9.6	9.5	8.0			
max	24.0	16.0	14.0			
avg	13.8	11.7	11.9			12.4

IG9

	1988	1989	1990	min	max	avg
MAY	20.5	20.5	19.5	19.5	20.5	20.2
JUNE		17.5	13.0	13.0	17.5	15.3
JULY	17.6	20.0	18.5	17.6	20.0	18.7
AUG	23.5	21.5	34.0	21.5	34.0	26.3
SEPT		36.5	30.5	30.5	36.5	33.5
OCT	19.5			19.5	19.5	19.5
NOV	22.5		24.0	22.5	24.0	23.3
min	17.6	17.5	13.0			
max	23.5	36.5	34.0			
avg	20.7	23.2	23.3			22.4

IG10

	1988	1989	1990	min	max	avg
MAY	12.2	7.5	12.5	7.5	12.5	10.7
JUNE		14.0	11.0	11.0	14.0	12.5
JULY	9.6	11.0	7.5	7.5	11.0	9.4
AUG	16.0	12.0	14.5	12.0	16.0	14.2
SEPT		14.5	16.0	14.5	16.0	15.3
OCT	11.9			11.9	11.9	11.9
NOV	16.2		12.0	12.0	16.2	14.1
min	9.6	7.5	7.5			
max	16.2	14.5	16.0			
avg	13.2	11.8	12.3			12.4

IG11

	1988	1989	1990	min	max	avg
MAY	9.8	9.0	18.0	9.0	18.0	12.3
JUNE		12.5	17.0	12.5	17.0	14.8
JULY	14.0	11.5	8.0	8.0	14.0	11.2
AUG	18.0	27.0	20.5	18.0	27.0	21.8
SEPT		19.5	12.5	12.5	19.5	16.0
OCT	12.3		16.5	12.3	16.5	14.4
NOV	1.8			1.8	1.8	1.8
min	1.8	9.0	8.0			
max	18.0	27.0	20.5			
avg	11.2	15.9	15.4			14.2

IG12

	1988	1989	1990	min	max	avg
MAY	12.1	12.5	10.5	10.5	12.5	11.7
JUNE		13.5	10.5	10.5	13.5	12.0
JULY	11.7	10.0	8.0	8.0	11.7	9.9
AUG	16.5	11.0	15.5	11.0	16.5	14.3
SEPT		15.0	14.5	14.5	15.0	14.8
OCT				ERR	ERR	ERR
NOV	11.7		12.0	11.7	12.0	11.9
min	11.7	10.0	8.0			
max	16.5	15.0	15.5			
avg	13.0	12.4	11.8			12.3

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IG13

	1988	1989	1990	min	max	avg
MAY	12.2	11.0	11.0	11.0	12.2	11.4
JUNE		17.0	10.0	10.0	17.0	13.5
JULY	12.8	12.0	5.5	5.5	12.8	10.1
AUG	16.9	12.0	14.0	12.0	16.9	14.3
SEPT		14.5	15.5	14.5	15.5	15.0
OCT				ERR	ERR	ERR
NOV	12.1		10.5	10.5	12.1	11.3
min	12.1	11.0	5.5			
max	16.9	17.0	15.5			
avg	13.5	13.3	11.1			12.5

IG14

	1988	1989	1990	min	max	avg
MAY	13.4	11.0	11.0	11.0	13.4	11.8
JUNE		10.0	9.0	9.0	10.0	9.5
JULY	12.3	11.5	7.5	7.5	12.3	10.4
AUG	16.3	17.0	17.5	16.3	17.5	16.9
SEPT		13.0	14.0	13.0	14.0	13.5
OCT				ERR	ERR	ERR
NOV	6.9		12.0	6.9	12.0	9.5
min	6.9	10.0	7.5			
max	16.3	17.0	17.5			
avg	12.2	12.5	11.8			12.2

IG15

	1988	1989	1990	min	max	avg
MAY	10.3	10.5	13.0	10.3	13.0	11.3
JUNE		11.5	8.5	8.5	11.5	10.0
JULY	10.4	10.5	7.5	7.5	10.5	9.5
AUG	16.6	11.5	17.0	11.5	17.0	15.0
SEPT		14.5	17.0	14.5	17.0	15.8
OCT				ERR	ERR	ERR
NOV	12.6		12.5	12.5	12.6	12.6
min	10.3	10.5	7.5			
max	16.6	14.5	17.0			
avg	12.5	11.7	12.6			12.3

IG16

	1988	1989	1990	min	max	avg
MAY	33.0	41.5	13.5	13.5	41.5	29.3
JUNE		22.5	24.0	22.5	24.0	23.3
JULY	17.0	23.0	18.5	17.0	23.0	19.5
AUG	30.0	18.0	16.5	16.5	30.0	21.5
SEPT		16.0	15.0	15.0	16.0	15.5
OCT			21.5	21.5	21.5	21.5
NOV	50.5			50.5	50.5	50.5
min	17.0	16.0	13.5			
max	50.5	41.5	24.0			
avg	32.6	24.2	18.2			24.0

IG17

	1988	1989	1990	min	max	avg
MAY	22.0	20.5	9.5	9.5	22.0	17.3
JUNE		23.5	17.0	17.0	23.5	20.3
JULY	16.0	21.5	17.0	16.0	21.5	18.2
AUG	18.5	15.0	13.5	13.5	18.5	15.7
SEPT		15.5	13.0	13.0	15.5	14.3
OCT			19.5	19.5	19.5	19.5
NOV	19.5			19.5	19.5	19.5
min	16.0	15.0	9.5			
max	22.0	23.5	19.5			
avg	19.0	19.2	14.9			17.4

IG18

	1988	1989	1990	min	max	avg
MAY	22.0	11.5	10.0	10.0	22.0	14.5
JUNE		17.5	23.5	17.5	23.5	20.5
JULY	17.0	18.0	16.5	16.5	18.0	17.2
AUG	16.0	11.0	15.5	11.0	16.0	14.2
SEPT		13.0	13.0	13.0	13.0	13.0
OCT			16.0	16.0	16.0	16.0
NOV	19.0			19.0	19.0	19.0
min	16.0	11.0	10.0			
max	22.0	18.0	23.5			
avg	18.5	14.2	15.8			16.0

Nipissing Phosphorous

IG19

	1988	1989	1990	min	max	avg
MAY	22.5	13.0	22.0	13.0	22.5	19.2
JUNE		19.0	28.0	19.0	28.0	23.5
JULY	21.0	15.5	17.5	15.5	21.0	18.0
AUG	17.5	14.5	15.5	14.5	17.5	15.8
SEPT		18.0	17.5	17.5	18.0	17.8
OCT			15.5	15.5	15.5	15.5
NOV	23.5			23.5	23.5	23.5
min	17.5	13.0	15.5			
max	23.5	19.0	28.0			
avg	21.1	16.0	19.3			18.7

IG20

	1988	1989	1990	min	max	avg
MAY	19.0	10.5	14.0	10.5	19.0	14.5
JUNE		33.5	15.0	15.0	33.5	24.3
JULY	13.3	23.5	11.5	11.5	23.5	16.1
AUG	16.3	13.0	13.0	13.0	16.3	14.1
SEPT		13.0	11.5	11.5	13.0	12.3
OCT				ERR	ERR	ERR
NOV	31.0		12.5	12.5	31.0	21.8
min	13.3	10.5	11.5			
max	31.0	33.5	15.0			
avg	19.9	18.7	12.9			16.7

IG21

	1988	1989	1990	min	max	avg
MAY	15.8	11.0	15.0	11.0	15.8	13.9
JUNE		22.5	14.0	14.0	22.5	18.3
JULY	10.4	32.0	10.0	10.0	32.0	17.5
AUG	13.9	14.0	10.0	10.0	14.0	12.6
SEPT		12.0	12.0	12.0	12.0	12.0
OCT	20.0		12.0	12.0	20.0	16.0
NOV	15.7		16.0	15.7	16.0	15.9
min	10.4	11.0	10.0			
max	20.0	32.0	16.0			
avg	15.2	18.3	12.7			15.1

IG22

	1988	1989	1990	min	max	avg
MAY	12.8	8.0	13.5	8.0	13.5	11.4
JUNE		12.0	14.5	12.0	14.5	13.3
JULY	13.8	15.0	10.5	10.5	15.0	13.1
AUG	13.8		14.0	13.8	14.0	13.9
SEPT		14.0	13.5	13.5	14.0	13.8
OCT	10.1		14.0	10.1	14.0	12.1
NOV	9.9			9.9	9.9	9.9
min	9.9	8.0	10.5			
max	13.8	15.0	14.5			
avg	12.1	12.3	13.3			12.6

IG23

	1988	1989	1990	min	max	avg
MAY	10.1	10.5	8.5	8.5	10.5	9.7
JUNE		10.0	14.5	10.0	14.5	12.3
JULY	9.9	10.5	10.0	9.9	10.5	10.1
AUG	17.5	11.0	16.5	11.0	17.5	15.0
SEPT		13.0	15.5	13.0	15.5	14.3
OCT	11.7		13.5	11.7	13.5	12.6
NOV	11.8			11.8	11.8	11.8
min	9.9	10.0	8.5			
max	17.5	13.0	16.5			
avg	12.2	11.0	13.1			12.2

IG24

	1988	1989	1990	min	max	avg
MAY	9.6	10.5	12.5	9.6	12.5	10.9
JUNE		13.0	9.5	9.5	13.0	11.3
JULY	11.5	10.0	11.0	10.0	11.5	10.8
AUG	16.0	9.5	14.0	9.5	16.0	13.2
SEPT		12.0	13.5	12.0	13.5	12.8
OCT	10.8		10.0	10.0	10.8	10.4
NOV	11.3			11.3	11.3	11.3
min	9.6	9.5	9.5			
max	16.0	13.0	14.0			
avg	11.8	11.0	11.8			11.5

Nipissing Phosphorous (Outflow)

IG25

	1988	1989	1990	min	max	avg
MAY	12.3	13.5	13.5	12.3	13.5	13.1
JUNE		9.0	10.0	9.0	10.0	9.5
JULY	9.3	14.5	9.0	9.0	14.5	10.9
AUG	9.6	6.0	11.5	6.0	11.5	9.0
SEPT		9.5	12.5	9.5	12.5	11.0
OCT			16.5	16.5	16.5	16.5
NOV	13.0			13.0	13.0	13.0
min	9.3	6.0	9.0			
max	13.0	14.5	16.5			
avg	11.1	10.5	12.2			11.3

IG26

	1988	1989	1990	min	max	avg
MAY	13.8	12.0	17.0	12.0	17.0	14.3
JUNE		13.0	10.0	10.0	13.0	11.5
JULY	10.0	10.0	9.0	9.0	10.0	9.7
AUG	10.6	6.5	14.0	6.5	14.0	10.4
SEPT		9.5	11.0	9.5	11.0	10.3
OCT			13.5	13.5	13.5	13.5
NOV	10.6			10.6	10.6	10.6
min	10.0	6.5	9.0			
max	13.8	13.0	17.0			
avg	11.3	10.2	12.4			11.4

Nipissing Chlorophyll

IG1

	1988	1989	1990	min	max	avg
MAY	3.0	5.5	5.5	3.0	5.5	4.7
JUNE		1.3	3.6	1.3	3.6	2.5
JULY	2.2	2.2	1.8	1.8	2.2	2.1
AUG	2.0	5.1	4.3	2.0	5.1	3.8
SEPT		8.4	4.6	4.6	8.4	6.5
OCT	2.0		2.7	2.0	2.7	2.4
NOV	2.5			2.5	2.5	2.5
min	2.0	1.3	1.8			
max	3.0	8.4	5.5			
avg	2.3	4.5	3.8			3.5

IG2

	1988	1989	1990	min	max	avg
MAY	3.4	3.1	2.9	2.9	3.4	3.1
JUNE		1.0	3.5	1.0	3.5	2.3
JULY	1.4	2.2	1.8	1.4	2.2	1.8
AUG	3.8	4.6	2.9	2.9	4.6	3.8
SEPT		8.0	4.6	4.6	8.0	6.3
OCT			3.2	3.2	3.2	3.2
NOV	2.5			2.5	2.5	2.5
min	1.4	1.0	1.8			
max	3.8	8.0	4.6			
avg	2.8	3.8	3.2			3.3

IG3

	1988	1989	1990	min	max	avg
MAY	1.9	6.2	3.3	1.9	6.2	3.8
JUNE		0.8	2.0	0.8	2.0	1.4
JULY	1.7	1.9	2.3	1.7	2.3	2.0
AUG	1.9	2.9	2.8	1.9	2.9	2.5
SEPT		2.7	1.5	1.5	2.7	2.1
OCT			2.5	2.5	2.5	2.5
NOV	2.9			2.9	2.9	2.9
min	1.7	0.8	1.5			
max	2.9	6.2	3.3			
avg	2.1	2.9	2.4			2.5

IG4

	1988	1989	1990	min	max	avg
MAY	2.7	4.4	2.3	2.3	4.4	3.1
JUNE		0.9	2.4	0.9	2.4	1.7
JULY	2.2	2.3	2.2	2.2	2.3	2.2
AUG	3.1	4.2	3.0	3.0	4.2	3.4
SEPT		1.8	2.7	1.8	2.7	2.3
OCT	3.9		3.7	3.7	3.9	3.8
NOV	2.8			2.8	2.8	2.8
min	2.2	0.9	2.2			
max	3.9	4.4	3.7			
avg	2.9	2.7	2.7			2.8

IG5

	1988	1989	1990	min	max	avg
MAY	2.6	4.3	2.0	2.0	4.3	3.0
JUNE		0.7	2.7	0.7	2.7	1.7
JULY	1.7	2.3	2.5	1.7	2.5	2.2
AUG	1.8	2.6	2.3	1.8	2.6	2.2
SEPT		2.1	2.8	2.1	2.8	2.5
OCT			1.9	1.9	1.9	1.9
NOV	1.5			1.5	1.5	1.5
min	1.5	0.7	1.9			
max	2.6	4.3	2.8			
avg	1.9	2.4	2.4			2.3

IG6

	1988	1989	1990	min	max	avg
MAY	2.5	1.3	3.2	1.3	3.2	2.3
JUNE		0.9	1.9	0.9	1.9	1.4
JULY	1.9	2.0	1.0	1.0	2.0	1.6
AUG	1.2	2.3	2.2	1.2	2.3	1.9
SEPT		1.2	0.8	0.8	1.2	1.0
OCT			1.0	1.0	1.0	1.0
NOV	1.1			1.1	1.1	1.1
min	1.1	0.9	0.8			
max	2.5	2.3	3.2			
avg	1.7	1.5	1.7			1.6

Nipissing Chlorophyll

IG7

	1988	1989	1990	min	max	avg
MAY	14.0	5.4	10.4	5.4	14.0	9.9
JUNE		3.8	12.3	3.8	12.3	8.1
JULY	2.5	3.8	4.5	2.5	4.5	3.6
AUG	14.0	4.2	5.8	4.2	14.0	8.0
SEPT		3.9	3.3	3.3	3.9	3.6
OCT			38.0	38.0	38.0	38.0
NOV	4.8			4.8	4.8	4.8
min	2.5	3.8	3.3			
max	14.0	5.4	38.0			
avg	8.8	4.2	12.4			8.7

IG8

	1988	1989	1990	min	max	avg
MAY	4.1	1.3	2.5	1.3	4.1	2.6
JUNE		2.6	4.6	2.6	4.6	3.6
JULY	1.9	2.6	2.7	1.9	2.7	2.4
AUG	2.7	3.8	5.9	2.7	5.9	4.1
SEPT		3.0	6.2	3.0	6.2	4.6
OCT	4.0		3.2	3.2	4.0	3.6
NOV	5.4			5.4	5.4	5.4
min	1.9	1.3	2.5			
max	5.4	3.8	6.2			
avg	3.6	2.7	4.2			3.5

IG9

	1988	1989	1990	min	max	avg
MAY	6.0	2.0	6.2	2.0	6.2	4.7
JUNE		2.7	5.5	2.7	5.5	4.1
JULY	21.0	9.7	19.1	9.7	21.0	16.6
AUG	16.0	34.5	22.1	16.0	34.5	24.2
SEPT		5.5	14.4	5.5	14.4	10.0
OCT	5.2			5.2	5.2	5.2
NOV	4.0		7.5	4.0	7.5	5.8
min	4.0	2.0	5.5			
max	21.0	34.5	22.1			
avg	10.4	10.9	12.5			11.3

IG10

	1988	1989	1990	min	max	avg
MAY	3.5	0.8	5.9	0.8	5.9	3.4
JUNE		2.5	4.0	2.5	4.0	3.3
JULY	2.3	2.6	2.5	2.3	2.6	2.5
AUG	3.4	4.9	5.1	3.4	5.1	4.5
SEPT		4.2	5.7	4.2	5.7	5.0
OCT	2.3			2.3	2.3	2.3
NOV	2.7		8.5	2.7	8.5	5.6
min	2.3	0.8	2.5			
max	3.5	4.9	8.5			
avg	2.8	3.0	5.3			3.8

IG11

	1988	1989	1990	min	max	avg
MAY	3.2	4.0	4.9	3.2	4.9	4.0
JUNE		1.7	4.5	1.7	4.5	3.1
JULY	2.8	3.0	2.7	2.7	3.0	2.8
AUG	2.8	8.1	10.9	2.8	10.9	7.3
SEPT		8.2	5.1	5.1	8.2	6.6
OCT	2.9		5.1	2.9	5.1	4.0
NOV	2.9			2.9	2.9	2.9
min	2.8	1.7	2.7			
max	3.2	8.2	10.9			
avg	2.9	5.0	5.5			4.6

IG12

	1988	1989	1990	min	max	avg
MAY	3.1	2.0	2.8	2.0	3.1	2.6
JUNE		1.6	2.4	1.6	2.4	2.0
JULY	2.3	2.4	2.9	2.3	2.9	2.5
AUG	2.6	4.8	5.8	2.6	5.8	4.4
SEPT		2.8	4.8	2.8	4.8	3.8
OCT				ERR	ERR	ERR
NOV	6.5		7.9	6.5	7.9	7.2
min	2.3	1.6	2.4			
max	6.5	4.8	7.9			
avg	3.6	2.7	4.4			3.6

Nipissing Chlorophyll

IG13

	1988	1989	1990	min	max	avg
MAY	3.3	2.0	2.7	2.0	3.3	2.7
JUNE		1.7	3.1	1.7	3.1	2.4
JULY	2.1	2.8	2.7	2.1	2.8	2.5
AUG	1.8	5.1	4.7	1.8	5.1	3.9
SEPT		3.4	3.9	3.4	3.9	3.7
OCT				ERR	ERR	ERR
NOV	8.8		3.4	3.4	8.8	6.1
min	1.8	1.7	2.7			
max	8.8	5.1	4.7			
avg	4.0	3.0	3.4			3.4

IG14

	1988	1989	1990	min	max	avg
MAY	4.4	0.8	2.8	0.8	4.4	2.7
JUNE		3.5	4.9	3.5	4.9	4.2
JULY	2.9	2.1	3.0	2.1	3.0	2.7
AUG	5.6	6.7	8.8	5.6	8.8	7.0
SEPT		1.9	4.8	1.9	4.8	3.4
OCT				ERR	ERR	ERR
NOV	3.1		2.3	2.3	3.1	2.7
min	2.9	0.8	2.3			
max	5.6	6.7	8.8			
avg	4.0	3.0	4.4			3.8

IG15

	1988	1989	1990	min	max	avg
MAY	3.4	5.6	2.3	2.3	5.6	3.8
JUNE		2.1	2.8	2.1	2.8	2.5
JULY	2.6	1.9	3.8	1.9	3.8	2.8
AUG	5.4	5.5	7.4	5.4	7.4	6.1
SEPT		3.6	3.5	3.5	3.6	3.6
OCT				ERR	ERR	ERR
NOV	3.0		6.3	3.0	6.3	4.7
min	2.6	1.9	2.3			
max	5.4	5.6	7.4			
avg	3.6	3.7	4.4			3.9

IG16

	1988	1989	1990	min	max	avg
MAY	7.2	3.4	7.1	3.4	7.2	5.9
JUNE		2.5	5.5	2.5	5.5	4.0
JULY	2.2	3.4	3.5	2.2	3.5	3.0
AUG	9.3	5.4	4.2	4.2	9.3	6.3
SEPT		2.7	2.5	2.5	2.7	2.6
OCT			7.0	7.0	7.0	7.0
NOV	13.0			13.0	13.0	13.0
min	2.2	2.5	2.5			
max	13.0	5.4	7.1			
avg	7.9	3.5	5.0			5.3

IG17

	1988	1989	1990	min	max	avg
MAY	5.9	3.0	0.0	0.0	5.9	3.0
JUNE		3.0	4.5	3.0	4.5	3.8
JULY	3.2	3.4	2.9	2.9	3.4	3.2
AUG	2.2	3.0	2.9	2.2	3.0	2.7
SEPT		2.5	1.5	1.5	2.5	2.0
OCT			4.5	4.5	4.5	4.5
NOV	5.6			5.6	5.6	5.6
min	2.2	2.5	0.0			
max	5.9	3.4	4.5			
avg	4.2	3.0	2.7			3.2

IG18

	1988	1989	1990	min	max	avg
MAY	6.5	2.6	6.5	2.6	6.5	5.2
JUNE		2.3	4.1	2.3	4.1	3.2
JULY	3.5	3.1	2.4	2.4	3.5	3.0
AUG	3.2	2.5	2.5	2.5	3.2	2.7
SEPT		2.6	1.8	1.8	2.6	2.2
OCT			3.2	3.2	3.2	3.2
NOV	4.0			4.0	4.0	4.0
min	3.2	2.3	1.8			
max	6.5	3.1	6.5			
avg	4.3	2.6	3.4			3.4

Nipissing Chlorophyll

IG19

	1988	1989	1990	min	max	avg
MAY	8.7	2.8	0.0	0.0	8.7	3.8
JUNE		2.0	4.2	2.0	4.2	3.1
JULY	3.4	2.6	2.8	2.6	3.4	2.9
AUG	3.5	5.1	2.7	2.7	5.1	3.8
SEPT		5.0	3.7	3.7	5.0	4.4
OCT			4.0	4.0	4.0	4.0
NOV	4.2			4.2	4.2	4.2
min	3.4	2.0	0.0			
max	8.7	5.1	4.2			
avg	5.0	3.5	2.9			3.6

IG20

	1988	1989	1990	min	max	avg
MAY	6.0	2.5	1.7	1.7	6.0	3.4
JUNE		1.8	3.0	1.8	3.0	2.4
JULY	1.9	5.5	1.6	1.6	5.5	3.0
AUG	2.4	2.8	2.0	2.0	2.8	2.4
SEPT		2.7	1.8	1.8	2.7	2.3
OCT				ERR	ERR	ERR
NOV	5.9		3.3	3.3	5.9	4.6
min	1.9	1.8	1.6			
max	6.0	5.5	3.3			
avg	4.1	3.1	2.2			3.0

IG21

	1988	1989	1990	min	max	avg
MAY	2.3	0.8	0.0	0.0	2.3	1.0
JUNE		0.9	3.1	0.9	3.1	2.0
JULY	2.0	3.3	2.3	2.0	3.3	2.5
AUG	3.4	3.5	2.7	2.7	3.5	3.2
SEPT		3.5	1.9	1.9	3.5	2.7
OCT	1.8		3.3	1.8	3.3	2.6
NOV	5.4			5.4	5.4	5.4
min	1.8	0.8	0.0			
max	5.4	3.5	3.3			
avg	3.0	2.4	2.2			2.5

IG22

	1988	1989	1990	min	max	avg
MAY	2.7	0.6	2.5	0.6	2.7	1.9
JUNE		1.1	2.5	1.1	2.5	1.8
JULY	2.4	2.4	2.8	2.4	2.8	2.5
AUG	3.8	3.8	5.1	3.8	5.1	4.2
SEPT		2.2	4.0	2.2	4.0	3.1
OCT	3.7		2.8	2.8	3.7	3.2
NOV	6.6			6.6	6.6	6.6
min	2.4	0.6	2.5			
max	6.6	3.8	5.1			
avg	3.8	2.0	3.3			3.1

IG23

	1988	1989	1990	min	max	avg
MAY	3.0	1.7	2.8	1.7	3.0	2.5
JUNE		1.5	3.5	1.5	3.5	2.5
JULY	2.0	3.0	2.4	2.0	3.0	2.5
AUG	2.6	2.8	4.9	2.6	4.9	3.4
SEPT		2.5	4.2	2.5	4.2	3.4
OCT	3.8		4.5	3.8	4.5	4.2
NOV	6.1			6.1	6.1	6.1
min	2.0	1.5	2.4			
max	6.1	3.0	4.9			
avg	3.5	2.3	3.7			3.2

IG24

	1988	1989	1990	min	max	avg
MAY	3.1	1.4	3.0	1.4	3.1	2.5
JUNE		1.1	2.9	1.1	2.9	2.0
JULY	2.1	2.8	2.6	2.1	2.8	2.5
AUG	4.3	3.1	4.3	3.1	4.3	3.9
SEPT		2.8	4.6	2.8	4.6	3.7
OCT	3.2		4.7	3.2	4.7	4.0
NOV	6.1			6.1	6.1	6.1
min	2.1	1.1	2.6			
max	6.1	3.1	4.7			
avg	3.8	2.2	3.7			3.3

Nipissing Chlorophyll (Outflow)

IG25

	1988	1989	1990	min	max	avg
MAY	2.6	1.5	2.3	1.5	2.6	2.1
JUNE		1.6	4.0	1.6	4.0	2.8
JULY	2.1	2.7	2.0	2.0	2.7	2.3
AUG	2.6	4.7	4.3	2.6	4.7	3.9
SEPT		3.1	3.8	3.1	3.8	3.5
OCT			6.2	6.2	6.2	6.2
NOV	4.0			4.0	4.0	4.0
min	2.1	1.5	2.0			
max	4.0	4.7	6.2			
avg	2.8	2.7	3.8			3.2

IG26

	1988	1989	1990	min	max	avg
MAY	6.2	2.5	10.8	2.5	10.8	6.5
JUNE		1.6	4.3	1.6	4.3	3.0
JULY	2.6	2.5	2.4	2.4	2.6	2.5
AUG	2.0	4.0	4.2	2.0	4.2	3.4
SEPT		3.1	2.5	2.5	3.1	2.8
OCT			4.1	4.1	4.1	4.1
NOV	3.7			3.7	3.7	3.7
min	2.0	1.6	2.4			
max	6.2	4.0	10.8			
avg	3.6	2.7	4.7			3.8

Nipissing Total Inorganic Nitrogen

IG1

	1988	1989	1990	min	max	avg
MAY	98	142	170	98	170	137
JUNE		76	65	65	76	71
JULY	7	96	29	7	96	44
AUG	13	26	41	13	41	27
SEPT		16	42	16	42	29
OCT	2		54	2	54	28
NOV	4			4	4	4
min	2	16	29			
max	98	142	170			
avg	25	71	67			55

IG2

	1988	1989	1990	min	max	avg
MAY	70	46	66	46	70	61
JUNE		68	73	68	73	71
JULY	14	92	15	14	92	40
AUG	15	24	51	15	51	30
SEPT		24	26	24	26	25
OCT			30	30	30	30
NOV	25			25	25	25
min	14	24	15			
max	70	92	73			
avg	31	51	44			43

IG3

	1988	1989	1990	min	max	avg
MAY	33	24	66	24	66	41
JUNE		58	78	58	78	68
JULY	11	74	23	11	74	36
AUG	9	22	28	9	28	20
SEPT		30	22	22	30	26
OCT			30	30	30	30
NOV	16			16	16	16
min	9	22	22			
max	33	74	78			
avg	17	42	41			35

IG4

	1988	1989	1990	min	max	avg
MAY	59	40	72	40	72	57
JUNE		65	74	65	74	70
JULY	10	52	35	10	52	32
AUG	19	20	27	19	27	22
SEPT		34	16	16	34	25
OCT	4		34	4	34	19
NOV	18			18	18	18
min	4	20	16			
max	59	65	74			
avg	22	42	43			36

IG5

	1988	1989	1990	min	max	avg
MAY	79	42	58	42	79	60
JUNE		54	64	54	64	59
JULY	5	52	33	5	52	30
AUG	8	12	19	8	19	13
SEPT		18	18	18	18	18
OCT			70	70	70	70
NOV	55			55	55	55
min	5	12	18			
max	79	54	70			
avg	37	36	44			39

IG6

	1988	1989	1990	min	max	avg
MAY	74	50	44	44	74	56
JUNE		38	44	38	44	41
JULY	8	28	78	8	78	38
AUG	4	6	23	4	23	11
SEPT		32	12	12	32	22
OCT			72	72	72	72
NOV	60			60	60	60
min	4	6	12			
max	74	50	78			
avg	37	31	46			38

Nipissing Total Inorganic Nitrogen

IG7

	1988	1989	1990	min	max	avg
MAY	33	18	42	18	42	31
JUNE		36	126	36	126	81
JULY	23	50	52	23	52	42
AUG	14	24	67	14	67	35
SEPT		48	40	40	48	44
OCT			196	196	196	196
NOV	140			140	140	140
min	14	18	40			
max	140	50	196			
avg	53	35	87			61

IG8

	1988	1989	1990	min	max	avg
MAY	75	88	108	75	108	90
JUNE		80	66	66	80	73
JULY	9	74	58	9	74	47
AUG	25	30	43	25	43	33
SEPT		12	22	12	22	17
OCT	2		44	2	44	23
NOV	3			3	3	3
min	2	12	22			
max	75	88	108			
avg	23	57	57			46

IG9

	1988	1989	1990	min	max	avg
MAY	131	166	154	131	166	150
JUNE		94	74	74	94	84
JULY	1	64	34	1	64	33
AUG	14	28	118	14	118	53
SEPT		220	76	76	220	148
OCT	28			28	28	28
NOV	31		78	31	78	55
min	1	28	34			
max	131	220	154			
avg	41	114	89			82

IG10

	1988	1989	1990	min	max	avg
MAY	77	37	128	37	128	81
JUNE		78	60	60	78	69
JULY	1	76	49	1	76	42
AUG	8	22	38	8	38	23
SEPT		14	20	14	20	17
OCT	28			28	28	28
NOV	2		29	2	29	16
min	1	14	20			
max	77	78	128			
avg	23	45	54			42

IG11

	1988	1989	1990	min	max	avg
MAY	107	146	180	107	180	144
JUNE		72	189	72	189	131
JULY	20	122	59	20	122	67
AUG	14	48	219	14	219	94
SEPT		62	28	28	62	45
OCT	3		276	3	276	140
NOV	11			11	11	11
min	3	48	28			
max	107	146	276			
avg	31	90	159			97

IG12

	1988	1989	1990	min	max	avg
MAY	69	76	86	69	86	77
JUNE		66	70	66	70	68
JULY	3	76	38	3	76	39
AUG	22	26	11	11	26	20
SEPT		12	20	12	20	16
OCT				ERR	ERR	ERR
NOV	3		21	3	21	12
min	3	12	11			
max	69	76	86			
avg	24	51	41			40

Nipissing Total Inorganic Nitrogen

IG19

	1988	1989	1990	min	max	avg
MAY	20	24	38	20	38	27
JUNE		20	71	20	71	46
JULY	16	48	35	16	48	33
AUG	19	14	25	14	25	19
SEPT		28	42	28	42	35
OCT			44	44	44	44
NOV	6			6	6	6
min	6	14	25			
max	20	48	71			
avg	15	27	43			30

IG20

	1988	1989	1990	min	max	avg
MAY	38	16	94	16	94	49
JUNE		40	62	40	62	51
JULY	6	52	23	6	52	27
AUG	11	16	25	11	25	17
SEPT		20	28	20	28	24
OCT				ERR	ERR	ERR
NOV	8		33	8	33	21
min	6	16	23			
max	38	52	94			
avg	16	29	44			31

IG21

	1988	1989	1990	min	max	avg
MAY	67	70	120	67	120	86
JUNE		40	61	40	61	51
JULY	8	74	29	8	74	37
AUG	33	28	29	28	33	30
SEPT		24	24	24	24	24
OCT	8		62	8	62	35
NOV	1			1	1	1
min	1	24	24			
max	67	74	120			
avg	23	47	54			42

IG22

	1988	1989	1990	min	max	avg
MAY	63	42	96	42	96	67
JUNE		78	60	60	78	69
JULY	18	70	36	18	70	41
AUG	26		31	26	31	29
SEPT		12	18	12	18	15
OCT	2		44	2	44	23
NOV	2			2	2	2
min	2	12	18			
max	63	78	96			
avg	22	51	48			40

IG23

	1988	1989	1990	min	max	avg
MAY	85	84	66	66	85	78
JUNE		78	71	71	78	75
JULY	7	96	43	7	96	49
AUG	25	22	39	22	39	29
SEPT		14	20	14	20	17
OCT	2		30	2	30	16
NOV	2			2	2	2
min	2	14	20			
max	85	96	71			
avg	24	59	45			43

IG24

	1988	1989	1990	min	max	avg
MAY	77	78	84	77	84	80
JUNE		71	52	52	71	62
JULY	5	98	38	5	98	47
AUG	16	22	27	16	27	22
SEPT		16	16	16	16	16
OCT	2		16	2	16	9
NOV	1			1	1	1
min	1	16	16			
max	77	98	84			
avg	20	57	39			39

Nipissing Total Inorganic Nitrogen

IG13

	1988	1989	1990	min	max	avg
MAY	70	56	70	56	70	65
JUNE		104	68	68	104	86
JULY	8	70	39	8	70	39
AUG	27	18	22	18	27	22
SEPT		8	20	8	20	14
OCT				ERR	ERR	ERR
NOV	4		22	4	22	13
min	4	8	20			
max	70	104	70			
avg	27	51	40			40

IG14

	1988	1989	1990	min	max	avg
MAY	83	22	122	22	122	76
JUNE		68	48	48	68	58
JULY	3	66	41	3	66	37
AUG	10	16	25	10	25	17
SEPT		10	20	10	20	15
OCT				ERR	ERR	ERR
NOV	4		16	4	16	10
min	3	10	16			
max	83	68	122			
avg	25	36	45			37

IG15

	1988	1989	1990	min	max	avg
MAY	79	88	76	76	88	81
JUNE		80	66	66	80	73
JULY	3	78	48	3	78	43
AUG	14	16	31	14	31	20
SEPT		10	16	10	16	13
OCT				ERR	ERR	ERR
NOV	5		12	5	12	9
min	3	10	12			
max	79	88	76			
avg	25	54	42			41

IG16

	1988	1989	1990	min	max	avg
MAY	18	72	72	18	72	54
JUNE		28	61	28	61	45
JULY	16	62	46	16	62	41
AUG	5	18	35	5	35	19
SEPT		26	34	26	34	30
OCT			48	48	48	48
NOV	45			45	45	45
min	5	18	34			
max	45	72	72			
avg	21	41	49			39

IG17

	1988	1989	1990	min	max	avg
MAY	26	34	78	26	78	46
JUNE		30	59	30	59	45
JULY	9	64	36	9	64	36
AUG	8	14	33	8	33	18
SEPT		24	32	24	32	28
OCT			48	48	48	48
NOV	2			2	2	2
min	2	14	32			
max	26	64	78			
avg	11	33	48			33

IG18

	1988	1989	1990	min	max	avg
MAY	24	22	74	22	74	40
JUNE		18	57	18	57	38
JULY	17	42	44	17	44	34
AUG	24	12	29	12	29	22
SEPT		22	34	22	34	28
OCT			44	44	44	44
NOV	6			6	6	6
min	6	12	29			
max	24	42	74			
avg	18	23	47			31

Nipissing Total Inorganic Nitrogen (Outflow)

IG25

	1988	1989	1990	min	max	avg
MAY	117	134	60	60	134	104
JUNE		60	64	60	64	62
JULY	10	62	42	10	62	38
AUG	25	10	33	10	33	23
SEPT		22	28	22	28	25
OCT			20	20	20	20
NOV	9			9	9	9
min	9	10	20			
max	117	134	64			
avg	40	58	41			46

IG26

	1988	1989	1990	min	max	avg
MAY	65	116	58	58	116	80
JUNE		56	53	53	56	55
JULY	10	46	39	10	46	32
AUG	32	8	33	8	33	24
SEPT		14	36	14	36	25
OCT			46	46	46	46
NOV	4			4	4	4
min	4	8	33			
max	65	116	58			
avg	28	48	44			41